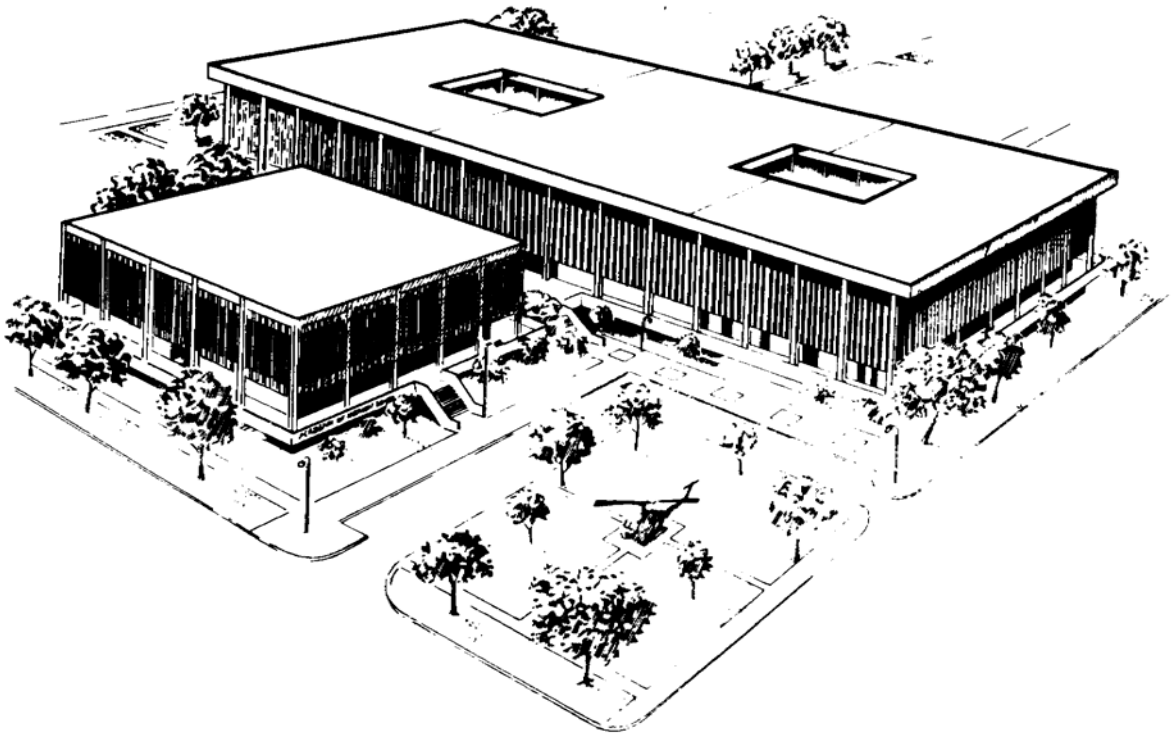
U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
FORT SAM HOUSTON, TEXAS 78234-6100



# PHARMACOLOGY MATH FOR THE PRACTICAL NURSE

SUBCOURSE MD0904 EDITION 100

## DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

## ADMINISTRATION

For comments or questions regarding enrollment, student records, or shipments, contact the Nonresident Instruction Section at DSN 471-5877, commercial (210) 221-5877, toll-free 1-800-344-2380; fax: 210-221-4012 or DSN 471-4012, e-mail accp@amedd.army.mil, or write to:

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Approved students whose enrollments remain in good standing may apply to the Nonresident Instruction Section for subsequent courses by telephone, letter, or e-mail.

Be sure your social security number is on all correspondence sent to the Academy of Health Sciences.

## CLARIFICATION OF TRAINING LITERATURE TERMINOLOGY

When used in this publication, words such as "he," "him," "his," and "men" are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.
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## SUBCOURSE MD0904

## Pharmacology Math for the Practical Nurse

## INTRODUCTION

One of the 91WM6's most important responsibilities is the safe administration of medication. Used intelligently and accurately, drugs can surely save countless numbers of lives; used unwisely, they can have disastrous results. It is imperative that you have a thorough understanding of the basic concepts of math as well as the specific mathematical skills required for pharmaceutical calculations.

Subcourse Components:

This subcourse consists of two lessons and a pretest. The lessons and pretest are:

**Lesson 1 Pretest.**

Lesson 1, Basic Math.

Lesson 2, Pharmacology.

Credit Awarded:

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Section at Fort Sam Houston, Texas. Upon successful completion of the examination for this subcourse, you will be awarded 12 credit hours.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

## PRETEST FOR LESSON 1

I. **COMMENTS**: This pretest is designed to help you identify the topics (if any) you need to review/study before going on to Lesson 2 of this subcourse.

You alone will know how you performed on the pretest. Your pretest results will not affect your score on the final examination for the subcourse.

Do your best. How well you perform on the pretest will determine how much of Lesson 1 you will need to study/review before you go on to Lesson 2.

II. **INSTRUCTIONS**: Please read and follow these instructions as closely as possible. The pay-off to you will be the wise use of your time.

STEP 1: Carefully read the instructions for the pretest.

STEP 2: Complete the 50-item pretest. Carefully read each item and write your answer in the space provided. Take as long as you need to complete the pretest.

STEP 3: Review your work. Be sure you wrote the correct answers.

STEP 4: Check your responses against the solutions following the pretest. Mark each of your responses as correct or incorrect.

STEP 5: Determine the number of items missed.

If you did not miss any items, you may skip Lesson 1 and proceed to Lesson 2.

If you missed only one or two items, read the paragraph(s) referenced to the right of the solution for each missed question to see why your answer was not correct. You may then proceed to Lesson 2.

If you missed more than two items, you should complete Lesson 1 before beginning Lesson 2.

**NOTE**: You may complete Lesson 1 even if you are not required to do so.

**Continue with Exercises**

## PRETEST

**NOTES**

Throughout this subcourse, division may be indicated by " ÷ " or by " / " or by the phrase "divided by." For example "8 divided by 4" may be shown as " 8÷4" or "8/4."

"Divided into" may be represented by $\overline{)}$ . **NOTE**: 4 divided into 8 ( $4\overline{)8}$ ) is the same as 8 divided by 4 (8 ÷ 4).

Fractions may be shown in linear (3/7) or vertical ( $\frac{3}{7}$ ) form.

Mixed numbers (whole number plus a fraction) may be shown in linear or vertical form.

For example, 3 7/8 and $3\frac{7}{8}$. Both mean three and seven-eights.

1. 19 + 8

2. 23 + 6 + 27

3. 4391 + 3019

4. 100 - 23

5. 956 - 927

6. 48 x 3

7. 85 x 35

8. 9873 ÷ 9 =

9. 175 ÷ 7 =

10. 2385 ÷ 25 =

11. Divide: $\frac{7}{8} \div \frac{1}{4}$ =

12. Divide: $6 \div \frac{1}{3}$ =

13. Multiply: $\frac{5}{6} \times \frac{2}{3}$ =

14. Multiply: $8 \times \frac{2}{3}$ =

15. Multiply: $2\frac{1}{2} \times 5\frac{1}{3}$ =

16. Divide: $6\frac{1}{2} \div 1\frac{1}{3}$ =

17. Change to a mixed number $\frac{6}{5}$ _____

18. Change to a whole number $\frac{28}{7}$ _____

19. Change to lowest terms $\frac{4}{8}$ _____

20. Change to an improper fraction $2\frac{4}{5}$ _____

21. Explain (put into words) 1.02 _____

**NOTE**: In answering items 22 through 30, round off to the 2nd decimal point.

22. Solve: $2.5 \div 2 =$

23. Solve: $3.45 \div 10 =$

24. Solve: $15 \div 1.3 =$

25. Solve: $66 \div 2.5 =$

26. Solve: $5.75 \div 0.25 =$

27. Solve: $7.125 \times 1.3 =$

28. Solve: $6.01 \times 7 =$

29. Convert to decimals: $\frac{1}{6} =$

30. Convert to decimals: $\frac{3}{5} =$

31. Change 50% to a fraction. _____

32. Change $3\frac{1}{2}$ % to a fraction. _____

33. Change $\frac{1}{5}$ % to a fraction. _____

34. Change $\frac{1}{8}$ to a percent. _____

35. Change $\frac{1}{25}$ to a percent. _____

36. Change 5% to a decimal. _____

37. Change 2% to a decimal. _____

38. Change $\frac{3}{4}$ % to a decimal. _____

39. Change 0.1 to a percent. _____

40. Change 0.05 to a percent. _____

41. Write $\frac{1}{4}$ as a ratio. _____

42. Write 1:3 as a percent. _____ As a decimal. _____

43. Write 1:150 as a percent. _____ As a decimal. _____

44. Change 10% to a ratio. _____

45. Change 1% to a ratio. _____

46. Change 80% to a ratio. _____

47. Change 0.2 to a ratio. _____

48. Change 0.025 to a ratio. _____

49. Solve for x: 13:91 = x:14 _____

50. Solve for z: $\frac{z}{21} = \frac{5}{12}$ _____

**Check Your Answers on Next Page**

## PRETEST ANSWERS

Following are the answers to the pretest you have just taken. Carefully check your pretest.

### Basic Arithmetic

1. 27 (para 1-2)
2. 56 (para 1-2)
3. 7410 (para 1-2)
4. 77 (para 1-3)
5. 29 (para 1-3)
6. 144 (para 1-6)
7. 2975 (para 1-10)
8. 1097 (para 1-7)
9. 25 (para 1-7)
10. 95.4 or 95 2/5 (para 1-11)

### Fractions

11. $3\frac{1}{2}$ (paras 1-26, 1-18)
12. 18 (paras 1-26, 1-18)
13. $\frac{5}{9}$ (paras 1-23, 1-18)
14. $5\frac{1}{3}$ (paras 1-24, 1-18)
15. $13\frac{1}{3}$ (paras 1-25, 1-21, 1-18)

16. $4\ \frac{7}{8}$ (paras 1-26, 1-21, 1-18)

17. $1\ \frac{1}{5}$ (para 1-18)

18. 4 (para 1-18)

19. $\frac{1}{2}$ (para 1-17)

20. $\frac{14}{5}$ (para 1-21)

**Decimals**

21. One and two hundredths (para 1-29)

22. 1.25 (para 1-31)

23. 0.345 = 0.35 (para 1-31)

24. 11.538 = 11.54 (para 1-31)

25. 26.4 (para 1-31)

26. 23 (para 1-31)

27. 9.2625 = 9.26 (para 1-34)

28. 42.07 (para 1-34)

29. 0.166 = 0.17 (para 1-36)

30. 0.6 (para 1-36)

**Precentages**

31. $\frac{50}{100} = \frac{1}{2}$ (para 1-40)

32. $\frac{7}{200}$ (para 1-40)

33. $\frac{1}{500}$ (para 1-40)

34. $12\frac{1}{2}$ percent or 12.5 percent (para 1-41)

35. 4 percent (para 1-41)

36. 0.05 (para 1-42)

37. 0.02 (para 1-42)

38. 0.0075 (para 1-42)

39. 10% (para 1-43)

40. 5% (para 1-43)

**Ration and Proportion**

41. 1:4 (para 1-46)

42. $33\frac{1}{3}$ percent ; 0.33 (para 1-47)

43. $\frac{2}{3}$% ; 0.0067 (para 1-47)

44. 1:10 (para 1-50)

45. 1:100 (para 1-50)

46. 4:5 (para 1-50)

47. 1:5 (para 1-51)

48. 1:40 (para 1-51)

49. x = 2 (para 1-55)

50. z = 8.75 (para 1-55)

**End of Lesson 1 Pretest**

## LESSON ASSIGNMENT

| | |
|---|---|
| **LESSON 1** | Basic Math. |
| **TEXT ASSIGNMENT** | Paragraphs 1-1 through 1-57. |
| **LESSON OBJECTIVES** | After completing this lesson, you should be able to: |

1-1. Add, subtract, multiply, and divide whole numbers.

1-2. Reduce fractions to lowest terms.

1-3. Change improper fractions to mixed numbers or whole numbers and mixed numbers to improper fractions.

1-4. Add, subtract, multiply, and divide fractions and mixed numbers.

1-5. Add, subtract, divide, and multiply decimals.

1-6. Change decimals to fractions and fractions to decimals.

1-7. Solve problems using the ratio and proportion method.

**SUGGESTION** After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

## LESSON 1

## BASIC MATH

## Section I. Basic Arithmetic

### 1-1. GENERAL

a. **Whole Numbers.** The number zero and the counting numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, ...) are **whole numbers**. The first 10 whole numbers (0 through 9) are called **digits**.

b. **Powers of Ten.** Our number system is based upon the powers of ten. That is, the digit place to the immediate left of a given digit is worth ten times as much as the given digit place, and the digit place to the immediate right is worth one-tenth as much. For example, in the number 321, the one tells you how many ones (or units) are in the number, the two tells how many tens, and the three tells how many hundreds. See figure 1-1.

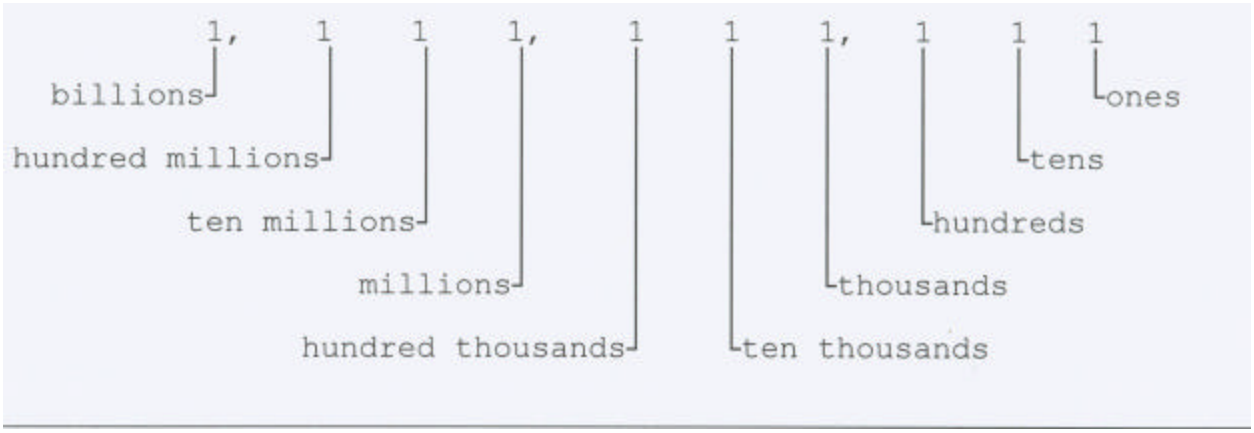



Figure 1-1. The number system.

### 1-2. SIMPLE ADDITION

a. The numbers to be added are the addends. The answer to an addition problem is the sum. When you are doing a problem in addition, work from right to left. Be sure to keep the columns of numbers in straight lines.

b. When you "carry" a number over to the next column to the left, you can jot it down at the top of the column.

**EXAMPLE**: Find the sum of 263, 19, and 1202.

```
  1          (the 1 is "carried")
 263  (addend)
  19  (addend)
+1202 (addend)
------
1484  (sum)
```

## 1-3. SIMPLE SUBTRACTION

a. The number "from which" another number is taken away is the "minuend." The number that is taken away is the "subtrahend." The answer is the "difference."

**EXAMPLE**: Subtract 4 from 17.

```
17 (minuend)
-4 (subtrahend)
13 (difference)
```

b. When you are doing a problem in subtraction, always remember to keep the columns of numbers in straight lines.

c. If the minuend in any column is smaller than the subtrahend, you can "borrow" from the next column to the left. This gives you ten more to work with in the right hand column but one less in the left hand column from which you have borrowed.

**EXAMPLE**: What is 35 minus 28?

```
 35
-28
```

To do the problem above, you have to change the 5 in the minuend to 15, and subtract 1 from 3 in the minuend.

```
 2 1  (10 is "borrowed")
 3 5
-2 8
-----
   7
```

## 1-4. PRACTICE 1-1

**DIRECTIONS**: Complete the following problems. The answers are in paragraph 1-5 on the following page. If you miss two or more problems, review the section again before proceeding with the subcourse. Follow the same instructions for the other practice exercises in the lesson.

a. Find the sum of 29 and 13.

b. Add 8 and 49.

c. 109 + 309 =

d. Add 13, 318, and 5.

e. What is the sum of 1713 and 1694?

f. Subtract 19 from 73.

g. 83 - 47 =

h. Subtract 233 from 2011.

i. From 220, subtract 59.

j. What is 100 - 39?

## 1-5. ANSWERS TO PRACTICE 1-1

a.
$$\begin{array}{r} {\scriptstyle 1\phantom{0}} \\ 29 \\ +13 \\ \hline 42 \end{array}$$

b.
$$\begin{array}{r} {\scriptstyle 1}8 \\ +49 \\ \hline 57 \end{array}$$

c.
$$\begin{array}{r} {\scriptstyle 1\phantom{00}} \\ 109 \\ +309 \\ \hline 418 \end{array}$$

d.
$$\begin{array}{r} {\scriptstyle 1\phantom{00}} \\ 13 \\ 318 \\ +\ 5 \\ \hline 336 \end{array}$$

e.
$$\begin{array}{r} {\scriptstyle 1\ 1\phantom{00}} \\ 1713 \\ 1694 \\ \hline 3407 \end{array}$$

f.
```
  6 1
   73
  -19
   54
```

g.
```
  7 1
   83
  -47
   36
```

h.
```
  1 9 10  1
   2 0 1 1
   - 2 3 3
   1 7 7 8
```

i.
```
    1 11  1
   2 2 0
   -  5 9
   1 6 1
```

j.
```
  0 9 1
  1 0 0
  - 3 9
    6 1
```

## 1-6. SIMPLE MULTIPLICATION

A number being multiplied is a "factor." The answer to a multiplication problem is a "product." When you multiply, a good habit is to keep the numbers in straight columns. This will help you in long multiplication problems.

**EXAMPLE**: Multiply 36 by 6.

```
 36 factor
x 6 factor
```

To work the problem above, follow these steps:

a. Multiply: 6 x 6 = 36. Write down the 6 and "carry" the 3.

```
  3
 36
x 6
  6
```

b. Multiply: 3 x 6 = 18. Add 3 (the number carried) to 18. 3+18 = 21.

$$\begin{array}{r} 36 \\ \times\ 6 \\ \hline 216 \end{array}$$

## 1-7. SIMPLE DIVISION

a. The number "being divided" is the dividend. The number you are "dividing by" is the divisor. The answer is the quotient.

**EXAMPLE**:

$$\begin{array}{rr} & 2 \text{ (quotient)} \\ \text{(divisor)} & 6\overline{)12}\ \text{(dividend)} \end{array}$$

b. Anything left over is the remainder.

**EXAMPLE**:

$$\begin{array}{r} 2 \\ 6\overline{)13} \\ \underline{12} \\ 1 \text{ (remainder)} \end{array}$$

c. The remainder can always be written as a fraction. The remainder becomes the numerator and the divisor becomes the denominator. Thus, the remainder in the problem above is 1/6. The quotient is 2 1/6.

## 1-8. PRACTICE 1-2

a. What is 53 times 3?

b. Multiply 1139 x 2.

c. 209 x 6 =

d. What is the product of 27 and 8?

e. What is 120 x 7?

f. Divide 64 by 8.

g. What is the quotient when 315 is divided by 5?

h. $3\overline{)18}$

i. How many times does 8 go into 4248?

j. $4\overline{)139}$

## 1-9. ANSWERS TO PRACTICE 1-2

a.
$$\begin{array}{r} 53 \\ \times\ 3 \\ \hline 159 \end{array}$$

b.
$$\begin{array}{r} {\scriptstyle 1} \\ 1139 \\ \times\ \ 2 \\ \hline 2278 \end{array}$$

c.
$$\begin{array}{r} {\scriptstyle 5} \\ 209 \\ \times\ \ 6 \\ \hline 1254 \end{array}$$

d.
$$\begin{array}{r} {\scriptstyle 5} \\ 27 \\ \times\ 8 \\ \hline 216 \end{array}$$

e.
$$\begin{array}{r} {\scriptstyle 1} \\ 120 \\ \times\ \ 7 \\ \hline 840 \end{array}$$

f.
$$\begin{array}{r} \ \ 8 \\ 8\overline{)64} \\ \underline{64} \\ \ \ 0 \end{array}$$

g.
$$\begin{array}{r} \ \ \ 63 \\ 5\overline{)315} \\ \underline{30} \\ \ \ 15 \\ \underline{15} \\ \ \ 0 \end{array}$$

h.
```
  6
3)18
 18
  0
```

i.
```
  531
8)4248
 40
  24
 24
  08
   8
   0
```

j.
```
  34 3/4
4)139
 12
  19
 16
  3
```

## 1-10. LONG MULTIPLICATION

a. The following procedure is used for multiplying factors with two or more digits.

**EXAMPLE**: Multiply 35 by 25.

```
  35 factors
x 25
 175 subproducts
700
875 product
```

STEPS followed in the problem above:

(1) Begin on the right and work left.

(2) First multiply 35 by 5. 5 x 5 is 25. Write down 5 in the unit column and carry the 2.

```
  2
  35
 x25
   5
```

(3) 5 x 3 = 15. 15 + 2 = 17. Write down 17 to the left of the 5. The first subproduct is 175.

$$\begin{array}{r} 35 \\ \times 25 \\ \hline 175 \end{array}$$

(4) Next, multiply 35 by 20. Place a zero in the ones (units) column and then multiply by 2. 2 x 5 = 10. Write down 0 and carry the 1.

$$\begin{array}{r} 35 \\ \times\ 25 \\ \hline 175 \\ 00 \end{array}$$

(5) 2 x 3 is 6. 6 + 1 = 7. Write down 7 next to the 0. The second subproduct is 700.

$$\begin{array}{r} 35 \\ \times\ 25 \\ \hline 175 \\ 700 \end{array}$$

(6) Add the two subproducts. 175 + 700 = 875. This is the product.

$$\begin{array}{r} 35 \\ \times\ 25 \\ \hline 175 \\ 700 \\ \hline 875 \end{array}$$

b. When multiplying any factor by 10, 100, 1000 and so on, add to the factor the same number of zeros that are in the second factor.

**EXAMPLE**: Multiply 93 by 10. There is one zero in the 10.
Therefore, add one zero to 93.
93 x 10 = 930.

## 1-11. LONG DIVISION

There are several techniques for doing long division. You may be used to a different technique from the one shown below. If you prefer another way, use it.

**EXAMPLE**: Divide 875 by 25.

$$\begin{array}{r} 35 \\ 25\overline{)875} \\ \underline{75} \\ 125 \\ \underline{125} \\ 0 \end{array}$$

STEPS followed in the problem above:

(1) Try to divide 25 into 87. About how many times will 25 go into 87? The answer is more than 3 but less than 4.

$$25\overline{)875}$$

(2) Write down 3 in the space for the quotient, directly above the 7.

$$\begin{array}{r} 3 \\ 25\overline{)875} \end{array}$$

(3) Now multiply 3 x 25 and write the answer under the 87. (3 x 25 = 75) Write 75 under the 87.

$$\begin{array}{r} {\scriptstyle 1}\ 3 \\ 25\overline{)875} \\ 75 \end{array}$$

(4) Subtract 75 from 87. The difference is 12. Write 12 directly under the 75.

$$\begin{array}{r} 3 \\ 25\overline{)875} \\ \underline{75} \\ 12 \end{array}$$

(5) Now "bring down" the 5 from the dividend. The 12 becomes 125.

$$\begin{array}{r} 3 \\ 25\overline{)875} \\ \underline{75} \\ 125 \end{array}$$

(6) Divide 125 by 25. The answer is 5. Write 5 in the space for the quotient, to the right of the 3.

```
   35
25)875
   75
  125
```

(7) Multiply 5 x 25 and write the answer under the 125. (5 x 25 = 125)

```
2  35
25)875
   75
  ---
  125
  125
```

(8) Subtract from 125. The difference is zero. Therefore, the quotient is exactly 35.

```
   35
25)875
   75
  125
  125
  ---
    0
```

**1-12. PRACTICE 1-3**

a. Multiply 284 by 12. _____

b. What is the product of 310 and 219? _____

c. Multiply 112 by 82. _____

d. Multiply 527 by 277. _____

e. 331 x 105 = _____

f. Divide 612 by 12. _____

g. Divide 3928 by 491. _____

h. If 3000 is divided by 75, what is the quotient? _____

i. If 360 is divided by 25, what is the quotient? _____

j. Divide 1425 by 15. _____

## 1-13. ANSWERS TO PRACTICE 1-3

a.
$$\begin{array}{r} {\scriptstyle 1}\\ 284\\ \times 112\\ \hline {\scriptstyle 1}568\\ {\scriptstyle 1}284\\ \hline 3408 \end{array}$$

b.
$$\begin{array}{r} 310\\ \times 219\\ \hline 2790\\ 310\\ 620\\ \hline 67890 \end{array}$$

c.
$$\begin{array}{r} 112\\ \times 82\\ \hline 224\\ {\scriptstyle 1}896\\ \hline 9184 \end{array}$$

d.
$$\begin{array}{r} 527\\ \times 277\\ \hline 3689\\ 3689\\ 1054\\ \hline 145979 \end{array}$$

e.
$$\begin{array}{r} 331\\ \times 105\\ \hline 1655\\ 3310\\ \hline 34755 \end{array}$$

f.
$$\begin{array}{r} 51\\ 12\overline{)612}\\ 60\\ \hline 12\\ 12\\ \hline 0 \end{array}$$

g.
$$\begin{array}{r} {\scriptstyle 7}\ 8\\ 491\overline{)3928}\\ 3928\\ \hline 0 \end{array}$$

h.
$$\begin{array}{r} 40\\ 75\overline{)3000}\\ 300\\ \hline 00\\ 00\\ \hline 0 \end{array}$$

i.
$$\begin{array}{r} 14.4\\ {\scriptstyle 2}25\overline{)360.0}\\ 25\\ \hline 110\\ 100\\ \hline 100\\ 100\\ \hline 0 \end{array} \quad \text{or} \quad \begin{array}{r} 14\\ {\scriptstyle 2}25\overline{)360}\\ 25\\ \hline 110\\ 100\\ \hline 10 \end{array} \quad \frac{10}{25} = 14\,\frac{2}{5}$$

j.
$$\begin{array}{r} 95\\ 15\overline{)1425}\\ 135\\ \hline 75\\ 75\\ \hline 0 \end{array}$$

## Section II. FRACTIONS

### 1-14. DEFINITION

A fraction is less than a whole amount. A whole number may be divided into one or more equal parts. It is expressed by two numbers separated by a line.

**EXAMPLES**: $\frac{1}{2}, \frac{1}{3}, \frac{2}{3}, \frac{4}{5}, \frac{5}{6}$.

### 1-15. PARTS OF FRACTIONS

The parts of a fraction are the numerator, or upper number, and the denominator, or bottom number.

**EXAMPLE**: In the fraction $\frac{1}{3}$, the "1" is the numerator, and the "3" is the denominator.

### 1-16. KINDS OF FRACTIONS

a. A proper fraction has a numerator that is smaller than the denominator.

**EXAMPLES**: The fraction $\frac{1}{4}$ is a proper fraction because the numerator, "1" is smaller than the denominator. "4."

Other examples are: $\frac{1}{2}, \frac{3}{4},$ and $\frac{7}{8}$.

b. An improper fraction has a numerator that is larger than the denominator or equal to the denominator.

**EXAMPLES**: The fraction $\frac{4}{3}$ is an improper fraction because the numerator "4" is larger than the denominator "3."

Other examples are $\frac{9}{2}, \frac{5}{3},$ and $\frac{3}{3}$.

c. A mixed number is made up of a whole number and a fraction.

**EXAMPLES**: $2\frac{3}{4}$ is a mixed number because it has a whole number "2" and a fraction "3/4".

Other examples are: $3\frac{1}{4}$, $1\frac{1}{3}$, and 4 1/8.

## 1-17. CHANGING FRACTIONS TO LOWEST POSSIBLE TERMS

Some fractions can (and should) be changed (reduced) to their lowest terms. This is done by dividing the numerator and denominator by the same number. This should be the largest possible number that will go into the numerator and denominator. A fraction is said to be at its lowest terms when the numerator and denominator cannot be divided by the same number to arrive at a lower numerator and denominator.

**EXAMPLE**: Reduce the fraction $\frac{9}{12}$.

What number goes into 9 and 12 evenly?
The answer is 3.
Divide the numerator by 3. 9 divided by 3 = 3.

$$\frac{9}{12} = \frac{3}{}$$

Divide the denominator by 3. 12 divided by 3 = 4.

$$\frac{9}{12} = \frac{3}{4}$$

Therefore, $\frac{9}{12}$ can be reduced to $\frac{3}{4}$.

These two fractions are equal in value.

Remember, reducing does not change the value of a fraction.

## 1-18. CHANGING IMPROPER FRACTIONS TO MIXED NUMBERS OR WHOLE NUMBERS

Improper fractions are changed to mixed or whole numbers by dividing the numerator by the denominator.

**EXAMPLES**: $\frac{8}{4} = 8 \div 4 = 2$ (a whole number)

$\frac{6}{5} = 6 \div 5 = 1\ \frac{1}{5}$ (a mixed number)

## 1-19. PRACTICE 1-4

a. Identify the following as proper fractions, improper fractions, or mixed numbers:

(1) $7\frac{1}{5}$ _____

(2) $\frac{1}{3}$ _____

(3) $\frac{100}{150}$ _____

(4) $\frac{30}{10}$ _____

(5) $\frac{119}{200}$ _____

(6) $6\frac{1}{5}$ _____

b. Change these proper fractions to their lowest terms:

(1) $\frac{2}{8}$ =

(2) $\frac{25}{75}$ =

(3) $\frac{3}{9}$ =

(4) $\frac{8}{32}$ =

(5) $\frac{5}{15}$ =

(6) $\frac{6}{18}$ =

c. Change the following improper fractions to whole or mixed numbers:

(1) $\frac{4}{2}$ =

(2) $\frac{30}{5}$ =

(3) $\frac{14}{12}$ =

(4) $\frac{9}{7}$ =

(5) $\frac{15}{10}$ =

(6) $\frac{9}{6}$ =

## 1-20. ANSWERS TO PRACTICE 1-4

a. (1) Mixed

(2) Proper

(3) Proper

(4) Improper

(5) Proper

(6) Mixed

b. (1) $\frac{2}{8} = \frac{1}{4}$ (2 ÷ 2 = 1) (8 ÷ 2 = 4)

(2) $\frac{25}{75} = \frac{1}{3}$ (25 ÷ 25 = 1) (75 ÷ 25 = 3)

(3) $\frac{3}{9} = \frac{1}{3}$ (3 ÷ 3 = 1) (9 ÷ 3 = 3)

(4) $\frac{8}{32} = \frac{1}{4}$ (8 ÷ 8 = 1) (32 ÷ 8 = 4)

(5) $\frac{5}{15} = \frac{1}{3}$ (5 ÷ 5 = 1) (15 ÷ 5 = 3)

(6) $\frac{6}{18} = \frac{1}{3}$ (6 ÷ 6 = 1) (18 ÷ 6 = 3)

c. (1) $\frac{4}{2} = 2$ (4 ÷ 2 = 2)

(2) $\frac{30}{5} = 6$ (30 ÷ 5 = 6)

(3) $\frac{14}{12} = 1\frac{1}{6}$ (14 ÷ 12 = $1\frac{1}{6}$)

(4) $\frac{9}{7} = 1\frac{2}{7}$ (9 ÷ 7 = $1\frac{2}{7}$)

(5) $\frac{15}{10} = 1\frac{1}{2}$ (15 ÷ 10 = $1\frac{1}{2}$)

(6) $\frac{9}{6} = 1\frac{1}{2}$ (9 ÷ 6 = $1\frac{1}{2}$)

## 1-21. CHANGING MIXED NUMBERS TO IMPROPER FRACTIONS

Mixed numbers may be changed to improper fractions by:

a. Multiplying the whole number by the denominator of the fraction.

b. To this answer, adding the numerator of the fraction.

c. Placing this sum (or answer) over the denominator of the fraction.

**EXAMPLE**: Change $4\frac{2}{3}$ to an improper fraction.

STEPS: (1) 4 (whole number) x 3 (denominator) = 12

$$4\frac{2}{3} = \frac{12}{}$$

(2) 12 (answer from ABOVE) + 2 (numerator) = 14

$$4\frac{2}{3} = \frac{12}{} + 2 = \frac{14}{}$$

(3) 14 is placed over denominator = $\frac{14}{3}$

Thus $4\frac{2}{3} = \frac{12 + 2}{3} = \frac{14}{3}$

## 1-22. ADDITION AND SUBTRACTION OF FRACTIONS

a. When you add and subtract fractions, the denominators of these fractions must be the same. To make the denominators of two fractions the same, you have to find the smallest denominator into which each of the original denominators will divide evenly. This is the lowest common denominator.

**EXAMPLE**: You are given the fractions $\frac{1}{2}$ and $\frac{1}{5}$ and are asked to find the lowest common denominator.

What is the smallest number into which 2 and 5 will divide evenly?

The answer is 10. 10 is the lowest common denominator.

You must now change your fractions to tenths.

$\frac{1}{2} = \frac{1x5}{2x5} = \frac{5}{10}$ $\frac{1}{5} = \frac{1x2}{5x2} = \frac{2}{10}$

**REMEMBER**: The new fractions are the same in value as the old fractions.

b. To add fractions, find the lowest common denominator and change the fractions to fractions having the same denominator. Then add the numerators.

**EXAMPLE**: $\frac{1}{3} + \frac{3}{4} = ?$

Change fractions to the lowest common denominator.
Then add the numerators.

$\frac{1}{3} = \frac{4}{12}$

$\frac{3}{4} = \frac{9}{12}$

$\frac{4}{12} + \frac{9}{12} = \frac{13}{12}$ or $1\frac{1}{12}$

c. To subtract fractions, again find the lowest common denominator and change the fractions to fractions having the same denominator. Then, subtract the second numerator from the first numerator.

**EXAMPLE**: $\frac{3}{4} - \frac{1}{3} = ?$

$\frac{3}{4} = \frac{9}{12}$

$\frac{1}{3} = \frac{4}{12}$

$\frac{9}{12} - \frac{4}{12} = \frac{9-4}{12} = \frac{5}{12}$

## 1-23. MULTIPLYING TWO FRACTIONS

Two fractions may be multiplied by:

a. Multiplying the numerators.

b. Multiplying the denominators.

c. Reducing the answer to lowest possible terms.

**EXAMPLE**: $\frac{3}{4} \times \frac{2}{5} = \frac{3 \times 2}{4 \times 5} = \frac{6}{20} = \frac{3}{10}$ (reduced to lowest possible terms).

## 1-24. MULTIPLYING WHOLE NUMBERS AND FRACTIONS

Whole numbers and fractions may be multiplied by:

a. Changing the whole number to an improper fraction.

b. Multiplying the two fractions.

c. Reducing the answer to a mixed number in its lowest possible terms.

EXAMPLE: $4 \times \frac{2}{3} = \frac{4}{1} \times \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3}$

## 1-25. MULTIPLYING MIXED NUMBERS

Mixed numbers may be multiplied by:

a. Changing the mixed numbers to improper fractions.
b. Multiplying the two fractions.

c. Reducing the answer to a mixed number in its lowest possible terms.

**EXAMPLE**: $2\frac{1}{2} \times 4\frac{1}{3} = \frac{5}{2} \times \frac{13}{3} = 5 \times \frac{13}{2} \times 3 = \frac{65}{6} = 10\frac{5}{6}$

## 1-26. DIVIDING FRACTIONS

Fractions may be divided by:

a. Inverting the divisor (the number by which another number is divided). Inverting is done by reversing the upper number and the lower number of the fraction.

b. After inverting the divisor, multiplying.

c. Reducing the answer to lowest terms (and/or a mixed number).

**EXAMPLES**: $\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\frac{1}{8}$

$\frac{1}{3} \div \frac{1}{5} = \frac{1}{3} \times \frac{5}{1} = \frac{5}{3} = 1\frac{2}{3}$

$4\frac{1}{2} \div \frac{1}{3} = \frac{9}{2} \times \frac{3}{1} = \frac{27}{2} = 13\frac{1}{2}$

**1-27. PRACTICE 1-5**

**NOTE**: Remember to reduce answers to lowest terms when possible.

a. Change the following mixed numbers to improper fractions:

(1) $2\frac{3}{8}$ =

(2) $5\frac{1}{5}$ =

(3) $10\frac{2}{3}$ =

(4) $8\frac{1}{6}$ =

(5) $4\frac{1}{2}$ =

(6) 2 =

b. Multiply the following fractions:

(1) $\frac{5}{6} \times \frac{1}{.3}$ =

(2) $\frac{9}{10} \times \frac{3}{4}$ =

(3) $\frac{5}{8} \times \frac{1}{2}$ =

(4) $\frac{7}{8} \times \frac{2}{5}$ =

(5) $\frac{4}{5} \times \frac{3}{5} =$

(6) $\frac{1}{3} \times \frac{3}{8} =$

c. Multiply the following whole numbers and fractions:

(1) $7 \times \frac{1}{2} =$

(2) $10 \times \frac{1}{3} =$

(3) $11 \times \frac{1}{4} =$

(4) $9 \times \frac{2}{3} =$

(5) $15 \times \frac{2}{3} =$

(6) $6 \times \frac{1}{8} =$

d. Multiply the following mixed numbers:

(1) $3\frac{3}{5} \times 2\frac{1}{2} =$

(2) $9 \times 9\frac{1}{2} =$

(3) $3\frac{1}{8} \times 2\frac{1}{4} =$

(4) $2\frac{1}{4} \times 3\frac{1}{3} =$

(5) $5 \times 4\frac{1}{4} =$

(6) $8\frac{2}{3} \times 5\frac{1}{4} =$

e. Divide the following fractions and mixed numbers:

(1) $1\frac{1}{3} \div \frac{1}{2} =$

(2) $6 \div \frac{1}{3} =$

(3) $6\frac{1}{2} \div 2 =$

(4) $\frac{3}{4} \div \frac{1}{2} =$

(5) $7\frac{1}{2} \div 5\frac{1}{5} =$

(6) $8 \div \frac{1}{4} =$

## 1-28. ANSWERS TO PRACTICE 1-5

a. (1) $2\frac{3}{8} = \frac{19}{8}$ (2 x 8 = 16 + 3 = 19)

(2) $5\frac{1}{5} = \frac{26}{5}$ (5 x 5 = 25 + 1 = 26)

(3) $10\frac{2}{3} = \frac{32}{3}$ (10 x 3 = 30 + 2 = 32)

(4) $8\frac{1}{6} = \frac{49}{6}$ (8 x 6 = 48 + 1 = 49)

(5) $4\frac{1}{2} = \frac{9}{2}$ (4 x 2 = 8 + 1 = 9)

(6) $2 = \frac{2}{1}$

b. (1) $\frac{5}{6} \times \frac{1}{3} = \frac{5}{18}$ (5 x 1 = 5) (6 x 3 = 18)

(2) $\frac{9}{10} \times \frac{3}{4} = \frac{27}{40}$ (9 x 3 = 27) (10 x 4 = 40)

(3) $\frac{5}{8} \times \frac{1}{2} = \frac{5}{16}$ (5 x 1 = 5) (8 x 2 = 16)

(4) $\frac{7}{8} \times \frac{2}{5} = \frac{14}{40} = \frac{7}{20}$ (7 x 2 = 14) (8 x 5 = 40) (14 ÷ 2 = 7) (40 ÷ 2 = 20)

(5) $\frac{4}{5} \times \frac{3}{5} = \frac{12}{25}$ (4 x 3 = 12) (5 x 5 = 25)

(6) $\frac{1}{3} \times \frac{3}{8} = \frac{3}{24} = \frac{1}{8}$ (1 x 3 = 3) (3 x 8 = 24) (3 ÷ 3 = 1) (24 ÷ 3 = 8)

c. (1) $7 \times \frac{1}{2} = \frac{7}{2} = 3\frac{1}{2}$ (7 x 1 = 7) (1 x 2 = 2) (7 ÷ 2 = $3\frac{1}{2}$)

(2) $10 \times \frac{1}{3} = \frac{10}{3} = 3\frac{1}{3}$

(3) $11 \times \frac{1}{4} = \frac{11}{4} = 2\frac{3}{4}$

(4) $9 \times \frac{2}{3} = \frac{18}{3} = 6$ (or $\frac{\overset{3}{\cancel{9}}}{1} \times \frac{2}{\cancel{3}_{1}} = 6$)

(5) $15 \times \frac{2}{3} = \frac{30}{3} = 10$ (or $\frac{\overset{5}{\cancel{15}}}{1} \times \frac{2}{\cancel{3}_{1}} = 10$)

(6) $6 \times \frac{1}{8} = \frac{6}{8} = \frac{3}{4}$ (or $\frac{\overset{3}{\cancel{6}}}{1} \times \frac{1}{\cancel{8}_{4}} = \frac{3}{4}$)

d. (1) $3\frac{3}{5} \times 2\frac{1}{2} = \frac{18}{5} \times \frac{5}{2} = \frac{90}{10} = 9$ (or $\frac{\overset{9}{\cancel{18}}}{\cancel{5}_{1}} \times \frac{\overset{1}{\cancel{5}}}{\cancel{2}_{1}} = \frac{9}{1} = 9$)

(2) $9 \times 9\frac{1}{2} = \frac{9}{1} \times \frac{19}{2} = \frac{171}{2} = 85\frac{1}{2}$

(3) $3\frac{1}{8} \times 2\frac{1}{4} = \frac{25}{8} \times \frac{9}{4} = \frac{225}{32} = 7\frac{1}{32}$

(4) $2\frac{1}{4} \times 3\frac{1}{3} = \frac{9}{4} \times \frac{10}{3} = \frac{90}{12} = 7\frac{6}{12} = 7\frac{1}{2}$ (or $\frac{\overset{3}{\cancel{9}}}{\cancel{4}_{2}} \times \frac{\overset{5}{\cancel{10}}}{\cancel{3}_{1}} = \frac{15}{2}$)

(5) $5 \times 4\frac{1}{4} = \frac{5}{1} \times \frac{17}{4} = \frac{85}{4} = 21\frac{1}{4}$

(6) $8\frac{2}{3} \times 5\frac{1}{4} = \frac{26}{3} \times \frac{21}{4} = \frac{546}{12} = 45\frac{6}{12} = 45\frac{1}{2}$ or $\frac{\overset{13}{\cancel{26}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{7}{\cancel{21}}}{\underset{2}{\cancel{4}}} = \frac{91}{2}$

e. (1) $1\frac{1}{3} \div \frac{1}{2} = \frac{4}{3} \times \frac{2}{1} = \frac{8}{3} = 2\frac{2}{3}$

(2) $6 \div \frac{1}{3} = \frac{6}{1} \times \frac{3}{1} = \frac{18}{1} = 18$

(3) $6\frac{1}{2} \div 2 = \frac{13}{2} \times \frac{1}{2} = \frac{13}{4} = 3\frac{1}{4}$

(4) $\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$ (or $\frac{3}{\underset{2}{\cancel{4}}} \times \frac{\overset{1}{\cancel{2}}}{1} = \frac{3}{2} = 1\frac{1}{2}$)

(5) $7\frac{1}{2} \div 5\frac{1}{5} = \frac{15}{2} \times \frac{5}{26} = \frac{75}{52} = 1\frac{23}{52}$

(6) $8 \div \frac{1}{4} = \frac{8}{1} \times \frac{4}{1} = \frac{32}{1} = 32$

## Section III. DECIMALS

### 1-29. DEFINITION

a. The word "decimal" means ten. A decimal is a fraction whose denominator is ten or a multiple of ten.

b. All the numbers written to the left of the "decimal point" (a dot) are whole numbers. The numbers written to the right of the decimal point are "decimals" (less than one).

c. The first place to the right of the decimal point is for tenths, the second place for hundredths, the third for thousandths, and so forth.

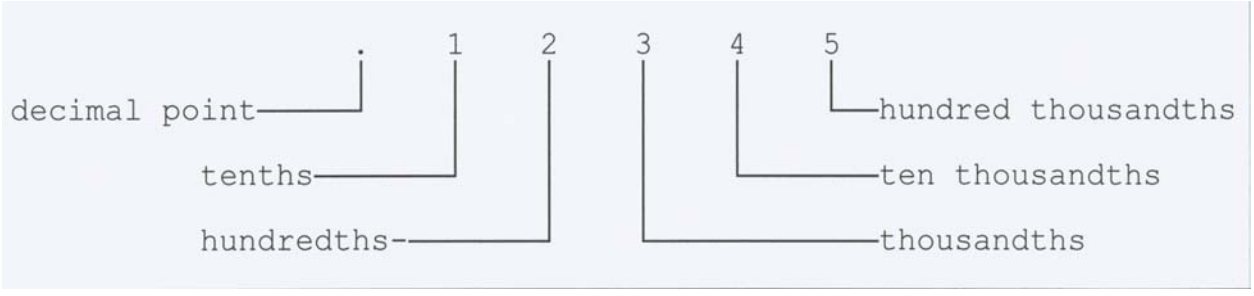



Figure 1-2. The decimal system.

**EXAMPLES**: 0.1 = one tenth

0.01 = one hundredth

0.001 = one thousandth

1.0 = one

10.0 = ten

100.0 = one hundred

1.1 = one and one tenth

10.01 = ten and one hundredth

## 1-30. ADDITION AND SUBTRACTION OF DECIMALS

When adding and subtracting decimals, remember to keep all the decimal points directly underneath each other.

**EXAMPLE**: Add 13.102, 1.73, and .47.

$$\begin{array}{r} 13.102 \\ 1.73 \\ +\ .47 \\ \hline 15.302 \end{array}$$

**EXAMPLE**: Subtract 4.56 from 8.2.

What you will need to do is change 8.2 to 8.20. (Remember, you can always add a zero to the end of a decimal without changing its value).

$$\begin{array}{r} 8.20 \\ -4.56 \\ \hline 3.64 \end{array}$$

## 1-31. DIVIDING DECIMALS

a. A decimal may be divided by a whole number by dividing in the usual manner and placing the decimal point in the answer directly above the decimal point in the number to be divided.

**EXAMPLE**: $5.5 \div 5 = 1.1$

$$
\begin{array}{r}
1.1 \\
5\overline{)5.5} \\
\underline{5} \\
5 \\
\underline{5} \\
0
\end{array}
$$

b. A whole number may be divided by a decimal by:

(1) Making the divisor a whole number by moving the decimal point to the right as many places as necessary.

(2) Placing a decimal point after the whole number (dividend) and then moving the decimal point the same number of places to the right as the decimal point in the divisor was moved.

(3) Divide in the usual manner.

**EXAMPLE**: 55 ÷ 0.2

$0.2\overline{)55} = 0.2.\overline{)55.0.} = 02\overline{)550.}$

Thus, 55 ÷ 0.2 = 275

c. Now to divide a decimal by a decimal, all we do is:

(1) Make the divisor a whole number.

(2) Move the decimal point in the dividend the same number of places as the decimal in the divisor was moved.

(3) Place the decimal point in the quotient directly above the decimal point in the dividend.

(4) Divide in the usual manner.

**EXAMPLE**: 5.25 ÷ 2.5 =

$2.5.\overline{)5.2.5} = 25\overline{)52.5} = 2.1$

Thus 5.25 ÷ 2.5 = 2.1

d. If a decimal is to be divided by a multiple of ten (10, 100, 1000, etc.), move the decimal point as many places to the left as there are zeroes in the divisor.

**EXAMPLE**: When dividing .2 by 100, move the decimal point one place to the left for each of the zeros in the divisor (the number you are dividing into the other number). There are two zeros; therefore, you move the decimal two places to the left.

.2 ÷ 100 = 0.00.2 = 0.002

**EXAMPLES**:

(1) 5 ÷ 10 = .5

(2) 5 ÷ 100 = .05

(3) 5 ÷ 1000 = .005

(4) 1.8 ÷ 10 = .18

(5) 1.8 ÷ 100 = .018

(6) 1.8 ÷ 1000 = .0018

e. Did you remember how to round off numbers? Whenever instructed to round off to a specific decimal place, solve the problem to one more place and round off.

**EXAMPLE**: (round to 2d decimal place)

52.5 – 5.2 = 10.096 = 10.10

## 1-32. PRACTICE 1-6

Round the following numbers to two decimal places.

a. 10.333 =

b. 11.625 =

c. 12.611 =

d. 3.237 =

e. 2.621 =

f. 0.396 =

Divide the following decimals; round off to second decimal place.

g. 100.25 ÷ 50.5 =

h. 40.5 ÷ 5.5 =

i. 82.5 ÷ 0.02 =

j. 44 ÷ 2.2 =

k. 56 ÷ 4.3 =

l. 43.6 ÷ 5 =

m. 3.6 ÷ 3 =

Work the following problems:

n. 6.2 ÷ 100 =

o. 20 ÷ 10 =

p. 4.3 ÷ 1000 =

q. .08 ÷ 100 =

r. .7 ÷ 10 =

s. 12.324 ÷ 100 =

t. 65 ÷ 1000 =

u. .025 ÷ 10 =

v. 1.34 ÷ 1000 =

w. 65.0 ÷ 100 =

**1-33. ANSWERS TO PRACTICE 1-6**

a. 10.33 b. 11.63

c. 12.61 d. 3.24

e. 2.62 f. 0.40

g.
```
    1.985
50.5.)100.2.500
      50 5
      49 7 5
      45 4 5
       4 3 00
       4 0 40
         2 600
         2 525
            75
```

h.
```
   7.363 = 7.36
5.5.)40.5.000
      38 5
       2 0 0
       1 6 5
       3 50
       3 30
         200
         165
          35
```

i.
```
    41 25.
0.02.)82.50.
       8
      02
      2
      0 5
        4
        10
        10
```

j.
```
   2 0.
2.2.)44.0.
      44
       0 0
       0 0
```

k.
```
    1 3.023 = 13.02
4.3.)56.0.000
       43
      13 0
      12 9
         1 0
           0
        1 00
          86
         140
         129
          11
```

l.
```
   8.72
5)43.60
   40
   —
    3 6
    3 5
    —
      10
      10
       0
```

m.
```
 1.2
3)3.6
 3
 0 6
   6
   0
```

| | | | |
|---|---|---|---|
| n. | .062 | o. | 2 |
| p. | .0043 | q. | .0008 |
| r. | .07 | s. | .12324 |
| t. | .065 | u. | .0025 |
| v. | .00134 | w. | .65 |

## 1-34. MULTIPLYING DECIMALS

Decimals can be multiplied by whole numbers and decimals by:

a. Multiplying in the usual manner.

b. Pointing off the proper number of decimal places.

5.25 x 5 = 26.25

$$\begin{array}{r} 5.25 \\ \times \quad 5 \\ \hline 26.25 \end{array}$$

(Two decimal places pointed off for the two places in 5.25)

**EXAMPLE:** 5.25 x 5.5 = 28.875

$$\begin{array}{r} 5.25 \\ \times 5.5 \\ \hline 2625 \\ 2625 \\ \hline 28.875 \end{array}$$

(Three decimal places pointed off for the three places in 5.25 and 5.5)

How many places would be pointed off in 3.24 x 3.56?

You are correct if you answered "four."

## 1-35. CHANGING DECIMALS TO FRACTIONS

Decimals can be changed to fractions by:

a. Removing the decimal point.

b. Placing the appropriate denominator under the number.

c. Reducing to lowest terms.

**EXAMPLE**: Change 0.05 to a fraction.

05 (decimal removed)

$\frac{05}{100}$ (note denominator) = $\frac{1}{20}$

## 1-36. CHANGING FRACTIONS TO DECIMALS

Fractions can be changed to decimals by dividing the numerator of the fraction by the denominator of the fraction.

**EXAMPLE**: Change $\frac{1}{2}$ to a decimal.

1 ÷ 2 (numerator ÷ denominator)

$$2\overline{)1.0} \quad \text{(quotient: } .5\text{)}$$

$\frac{1}{2} = 0.5$

## 1-37. PRACTICE 1-7

Multiply the following:

a. 3.33 x 2.02 =

b. 40.1 x 4.01 =

c. 2.55 x 20.5 =

d. 5.25 x 3.5 =

e. 7.05 x 7.5 =

f. 85.05 x 3.05 =

Change the following to fractions:

g. 0.35 =

h. 0.3 =

i. 0.04 =

j. 0.005 =

k. 0.75 =

l. 0.55 =

Change the following to decimals:

m. $\frac{1}{4}$ =

n. $\frac{1}{6}$ =

o. $\frac{7}{8}$ =

p. $\frac{5}{7}$ =

q. $\frac{2}{5}$ =

r. $\frac{1}{5}$ =

## 1-38. ANSWERS TO PRACTICE 1-7

a.
$$\begin{array}{r} 3.33 \\ \times\ 2.02 \\ \hline 666 \\ 6660 \\ \hline 6.7266 \end{array}$$

b.
$$\begin{array}{r} 40.1 \\ \times\ 4.01 \\ \hline 401 \\ 160\ 40 \\ \hline 160.801 \end{array}$$

c. 2.55
x 20.5
1 275
51 00
52.275

d. 5.25
x 3.5
2 625
15 75
18.375

e. 7.05
x 7.5
3 525
49 35
52.875

f. 85.05
x 3.05
4 2525
255 150
259.4025

g. $\frac{35}{100} = \frac{7}{20}$ (35 ÷ 5 = 7) (100 ÷ 5 = 20)

h. $\frac{3}{10}$

i. $\frac{4}{100} = \frac{1}{25}$ (4 ÷ 4 = 1) (100 ÷ 4 = 25)

j. $\frac{5}{1000} = \frac{1}{200}$ (5 ÷ 5 = 1) (1000 ÷ 5 = 200)

k. $\frac{75}{100} = \frac{3}{4}$ (75 ÷ 25 = 3) (100 ÷ 25 = 4)

l. $\frac{55}{100} = \frac{11}{20}$ (55 ÷ 5 = 11) (100 ÷ 5 = 20)

m. .25
4)1.00
8
20
20

n. .166 = 0.17
6)1.000
6
40
36
40
36
4

o. .875 = 0.88
8)7.000
6 4
60
56
40
40

p. .714 = 0.71
7)5.000
4 9
10
7
30
28
2

q. .4
5)2.0
2 0

r. .2
5)1.0
1 0

## Section IV. PERCENTAGES

**NOTE**: The final exam will not include information from Section IV. This is for your information only.

### 1-39. DEFINITION

Percentage means parts in 100. The term "percent" is usually indicated by the symbol "%."

### 1-40. CHANGING PERCENTAGES TO FRACTIONS

When the percentage is a whole number, mixed number, or fraction, it can be changed to a fraction by:

a. Omitting the percent sign.

b. Writing the whole number, mixed number, or fraction as the numerator.

c. Writing 100 as the denominator.

d. Reducing the resulting fraction to lowest terms.

**EXAMPLES**: Change 5% to a fraction.

$$5\% = \frac{5}{100} = \frac{1}{20}$$

Change $\frac{1}{2}\%$ to a fraction.

$$\frac{1}{2}\% = \frac{\frac{1}{2}}{100} = \frac{1}{2} \div \frac{100}{1} = \frac{1}{2} \times \frac{1}{100} = \frac{1}{200}$$

Change $5\ \frac{1}{2}\%$ to a fraction.

$$5\ \frac{1}{2}\% = 5\frac{\frac{1}{2}}{100} = \frac{11}{2} \cdot \frac{100}{1} = \frac{11}{2} \times \frac{1}{100} = \frac{11}{200}$$

## 1-41. CHANGING FRACTIONS TO PERCENTAGES

Fractions can be changed to percentages by:

a. Multiplying by 100.

b. Adding the percent symbol.

**EXAMPLE**: Change $\frac{1}{2}$ to a percent.

$$\frac{1}{2} \times \frac{100}{1} = \frac{100}{2} \times 50\%$$

## 1-42. CHANGING PERCENTAGES TO DECIMALS

Percentages can also be changed to decimals by removing the percent sign; then:

a. If the percentage is a whole number, divide by 100 (this can be done quickly by moving the decimal point two places to the left).

**EXAMPLE**: Change 10% to a decimal.

10% ⇒ 10. ⇒ 0.1

b. If the percentage is written as a fraction or mixed number, change to a decimal, and then move the decimal point two places to the left.

**EXAMPLE**: Change $\frac{1}{5}$% to a decimal.

$$\frac{1}{5}\% \rightarrow \frac{1}{5} \rightarrow 1 \div 5 = 0.2 \rightarrow 0.002$$

**EXAMPLE**: Change $3\frac{1}{2}$% to a decimal.

$$3\frac{1}{2}\% \rightarrow 3\frac{1}{2} = 7 \div 2 = 3.5 \rightarrow 0.035$$

## 1-43. CHANGING DECIMALS TO PERCENTAGES

A decimal can be changed to a percentage by:

a. Multiplying by 100 (this can be done by moving the decimal point two places to the right).

b. Adding a percent sign (%).

**EXAMPLE**: Change 0.5 to a percentage.

0.5 → 50. → 50%

## 1-44. PRACTICE 1-8

a. Change the following percentages to fractions:

(1) 6 %

(2) $\frac{1}{8}$ %

(3) $3\frac{1}{2}$ %

(4) $\frac{4}{5}$ %

(5) $12\frac{1}{2}\%$

(6) 30%

b. Change the following fractions to percentages:

(1) $\frac{3}{5}$

(2) $\frac{1}{8}$

(3) $\frac{1}{4}$

(4) $\frac{1}{100}$

(5) $\frac{1}{50}$

(6) $\frac{1}{25}$

c. Change the following percentages to decimals:

(1) $\frac{3}{4}$ %

(2) 50 %

(3) 40 %

(4) $2\frac{1}{2}$ %

(5) 6 %

(6) $6\frac{1}{5}$ %

d. Change the following decimals to percentages:

(1) 0.25

(2) 0.125

(3) 3.5

(4) 7.5

(5) 0.75

(6) 0.4

## 1-45. ANSWERS TO PRACTICE 1-8

a. (1) $\frac{6}{100} = \frac{3}{50}$ $(6 \div 2 = 3)$ $(100 \div 2 = 50)$

(2) $\frac{1/8}{100} = \frac{1}{8} \div \frac{100}{1} = \frac{1}{8} \times \frac{1}{100} = \frac{1}{800}$

(3) $\frac{3\frac{1}{2}}{100} = \frac{7}{2} \div \frac{100}{1} = \frac{7}{2} \times \frac{1}{100} = \frac{7}{200}$

(4) $\frac{\frac{4}{5}}{100} = \frac{4}{5} \div \frac{100}{1} = \frac{4}{5} \times \frac{1}{100} = \frac{4}{500} = \frac{1}{125}$ or $\frac{\cancel{4}^{1}}{5} \times \frac{1}{\cancel{100}_{25}} = \frac{1}{125}$

(5) $\frac{12\frac{1}{2}}{100} = \frac{25}{2} \div \frac{100}{1} = \frac{25}{2} \times \frac{1}{100} = \frac{25}{200} = \frac{1}{8}$ or $\frac{\cancel{25}^{1}}{2} \times \frac{1}{\cancel{100}_{4}} = \frac{1}{8}$

(6) $\frac{30}{100} = \frac{3}{10}$

b. (1) $\frac{3}{5} \times \frac{100}{1} = \frac{300}{} \rightarrow 60\%$ (or $\frac{3}{\cancel{5}_{1}} \times \frac{\cancel{100}^{20}}{1} = 60$)

(2) $\frac{1}{8} \times \frac{100}{1} = \frac{100}{8} \rightarrow 12\ 1/2\%$ or $12.5\%$) (or $\times \frac{1}{2} \frac{\cancel{100}^{25}}{1} = \frac{\cancel{25}}{2} = 12.5$)

(3) $\frac{1}{4} \times \frac{100}{1} = \frac{100}{4} \rightarrow 25\%$ (or $\frac{1}{\cancel{4}_{1}} \times \frac{\cancel{100}^{25}}{1} = 25$ )

(4) $\frac{1}{100} \times \frac{100}{1} = \frac{100}{100} \rightarrow 1\%$ (or $\frac{1}{\cancel{100}_{1}} \times \frac{\cancel{100}^{1}}{1} = 1$)

(5) $\frac{1}{50} \times \frac{100}{1} = \frac{100}{50} \rightarrow 2\%$ or ( $\frac{1}{\cancel{50}_{1}} \times \frac{\cancel{100}^{2}}{1} = 2$)

(6) $\frac{1}{25} \times \frac{100}{1} = \frac{100}{25} \rightarrow 4\%$ (or $\frac{1}{25_{1}} \times \frac{\cancel{100}^{4}}{1} = 4$)

c. (1)
$$\begin{array}{r} .75 \\ 4)3.00 \\ \underline{2\,8} \\ 20 \\ \underline{20} \\ 0 \end{array} \rightarrow 0.0075$$

(2) 0.5

(3) 0.4

(4) $2\frac{1}{2}\% \rightarrow \frac{5}{2}$
$$\begin{array}{r} 2.5 \\ 2)5.0 \\ \underline{4} \\ 1\,0 \\ \underline{1\,0} \\ 0 \end{array} \rightarrow 0.025$$

(5) 0.06

(6) $6\frac{1}{5}\% \rightarrow \frac{31}{5}$
$$\begin{array}{r} 6.2 \\ 5)31.0 \\ \underline{30} \\ 1\,0 \\ \underline{1\,0} \\ 0 \end{array} \rightarrow 0.062$$

d. (1) 25%

(2) 12.5% or $12\frac{1}{2}\%$

(3) 350%

(4) 750%

(5) 75%

(6) 40%

## Section V. RATIO AND PROPORTION

### 1-46. DEFINITION--RATIO

A ratio is a way of expressing a fractional part of a whole number. In a ratio, the numerator of the fraction is written in front of the denominator instead of over it.

**EXAMPLE**: In a ratio, the fraction $\frac{1}{2}$ would be written 1:2 or 1-2.

The symbol ":" or "-" is placed between the numbers of the ratio.

### 1-47. CHANGING A RATIO TO A PERCENTAGE OR DECIMAL

A ratio is changed to a percentage or decimal in the same way a fraction is changed to a percentage or decimal.

**EXAMPLE:** Change 1:50 to a percentage.

$$1:50 \rightarrow \frac{1}{50} \times \frac{100}{1} \rightarrow 2\%$$

**EXAMPLE**: Change 1:50 to a decimal.

$$1:50 = \frac{1}{50} = 1 \div 50 = 0.02$$

### 1-48. PRACTICE 1-9

a. Write the following as ratios:

(1) $\frac{1}{4}$ =

(2) $\frac{1}{100}$ =

(3) $\frac{1}{10}$ =

(4) $\frac{1}{1000}$ =

(5) $\frac{1}{50}$ =

(6) $\frac{1}{75}$ =

b. Change the following ratios to both decimals and percentages:

| Ratio | | Decimal | Percent |
|---|---|---|---|
| (1) | 1:3 | _____ | _____ |
| (2) | 1:1000 | _____ | _____ |
| (3) | 1:150 | _____ | _____ |

**1-49. ANSWERS TO PRACTICE 1-9**

a. (1) 1:4

(2) 1:100

(3) 1:10

(4) 1:1000

(5) 1:50

(6) 1:75

b. (1) 0.33 $33\frac{1}{3}\%$

(2) 0.001 $\frac{1}{10}\%$

(3) 0.00666 or 0.0067 $\frac{2}{3}\%$

## 1-50. CHANGING PERCENTAGES TO RATIOS

Changing a percentage to a ratio is the same as changing a percentage to a fraction.

**EXAMPLE**: Change 50% to a ratio.

$$50\% = .50 = \frac{50}{100} = \frac{1}{2} = 1:2$$

## 1-51. CHANGING DECIMALS TO RATIOS

This is calculated in the same manner as changing a decimal to a fraction.

EXAMPLE: Change 0.5 to a ratio.

$$0.5 = \frac{5}{10} = \frac{1}{2} = 1:2$$

## 1-52. PRACTICE 1-10

a. Change the following percentages to ratios:

(1) 10% _____

(2) $\frac{1}{2}\%$ _____

(3) 80% _____

(4) 40% _____

(5) $\frac{1}{4}\%$ _____

(6) 1% _____

b. Change the following decimals to ratios:

(1) 0.2 _____

(2) 0.025 _____

(3) 0.05 _____

(4) 0.001 _____

(5) 0.075 _____

(6) 0.1 _____

## 1-53. ANSWERS TO PRACTICE 1-10

a. (1) $.10 = \frac{10}{100} = \frac{1}{10} = 1:10$

(2) $\frac{\frac{1}{2}}{100} = \frac{1}{2} \div \frac{100}{1} = \frac{1}{2} \times \frac{1}{100} = \frac{1}{200} = 1:200$

(3) $.80 = \frac{80}{100} = \frac{8}{10} = \frac{4}{5} = 4:5$

(4) $.40 = \frac{40}{100} = \frac{4}{10} = \frac{2}{5} = 2:5$

(5) $\frac{1/4}{100} = \frac{1}{4} \div \frac{100}{1} = \frac{1}{4} \times \frac{1}{100} = \frac{1}{400} = 1:400$

(6) $.01 = \frac{1}{100} = 1:100$

b. (1) $\frac{2}{10} = \frac{1}{5} = 1:5$

(2) $\frac{25}{1000} = \frac{1}{40} = 1:40$

(3) $\frac{5}{100} = \frac{1}{20} = 1:20$

(4) $\frac{1}{1000} = 1:1000$

(5) $\frac{75}{1000} = \frac{3}{40} = 3:40$

(6) $\frac{1}{10} = 1:10$

## 1-54. DEFINITION--PROPORTION

An equation that tells us that one ratio is equal to another ratio is called a proportion.

**EXAMPLE**:

A baseball team wins 15 games out of 30 games played. If the team continues to win at the same rate, how many games will it win out of 40 games played?

a. Let N = number of games the team will win in 40 games played.

b. The ratio of games won to games already played is 15/30. Since the ratio of games won to games played is to remain the same, we may write this ratio as N/40. These ratios may also be written as 15:30 and N:40.

c. We may now write the equation 15/30 = N/40. This is our proportion.

## 1-55. PROPERTY OF PROPORTIONS

Proportions have a very useful property. Consider the proportion: $\frac{1}{3} = \frac{2}{6}$ or 1:3 =2:6.

a. The two inside terms (3 and 2) are called the "means" of the proportion, and the two outside terms (1 and 6) are called the "extremes" of the proportion.

b. Notice that if we multiply the two means, we obtain 3 x 2 = 6. Also, if we multiply the two extremes, we obtain 1 x 6 = 6. This illustrates the following property of proportions:

**In a proportion, the product of the means is equal to the product of the extremes.**

**EXAMPLE**: The ratio of alcohol to water in a certain type of antifreeze is 3:4. If a tank contains 24 quarts of alcohol, how many quarts of water must be added to make the antifreeze mixture?

Let X = the number of quarts needed.

$$\frac{\text{alcohol}}{\text{water}} \quad \frac{3}{4} = \frac{24}{X}$$

Now, use the property of proportions to find "X."

3:4 = 24:X
3X = 4 x 24
3X = 96
$\frac{1}{3}(3X) = \frac{1}{3}(96)$ or $\frac{3X}{3} = \frac{96}{3}$
X = 32 quarts of water

or

cross multiply

$\frac{3}{4} = \frac{24}{X}$

Multiply the numerator of the first ratio by the denominator of the second ratio. Then multiply the denominator of the first ratio by the numerator of the second ratio.

3X = 4 x 24
3X = 96
X = 32 quarts of water

**SECOND EXAMPLE**:

If three ties cost $12.57, what is the cost of five ties at the same rate?

Let y = the cost of five ties.

3:12.57 = 5:y

$\frac{3}{12.57} = \frac{5}{y}$

3y = 5 x 12.57 = 62.85

$\frac{1}{3}(3y) = \frac{1}{3}(62.85)$

y = $20.95

**1-56. PRACTICE 1-11**

a. 4:3 = 32:W W = _____

b. John earned $150 one week and spent $120. What is the ratio of the amount John saved to the amount John spent?

_____

c. The ratio of a father's age to his son's age is 9:2. If the son's age is 12 years, what is the age of the father (in years)?

_____

d. If three shirts cost $23, what is the cost of a dozen shirts at the same rate?

_____

e. A gallon of paint covers 240 square feet of surface. If a living room contains 906 square feet of paintable surface and a kitchen contains 334 square feet of surface, what is the number of gallons of paint needed for the living room and kitchen?

_____

**1-57. ANSWERS TO PRACTICE 1-11**

a. 4:3 = 32:W

4W = 3 x 32

4W = 96

W = 24

b. 30:120 = 1:4

c. 2:9 = 12:x

2X = 9 x 12

2X = 108

X = 54

d. 3:23 = 12:X

3X = 23 x 12

3X = 276

X = 92

e. 1:240 = X:1240 (1240 is the sum of 906 and 334)

1 x 1240 = 240X

1240 = 240X

$X = 5\frac{1}{6}$

**Continue with Exercises**

**EXERCISES, LESSON 1**

**INSTRUCTIONS:** Answer the following items by writing the answer in the space provided.

After you have completed all of these items, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. $\begin{array}{r} 2975 \\ \times\ 36 \\ \hline \end{array}$

2. $50\overline{)78340}$

3. $\begin{array}{r} 376 \\ -107 \\ \hline \end{array}$

4. $\begin{array}{r} 564 \\ \times\ 231 \\ \hline \end{array}$

5. $\begin{array}{r} 4791 \\ +3208 \\ \hline \end{array}$

6. $\begin{array}{r} 4638 \\ -3135 \\ \hline \end{array}$

7. $6\overline{)726}$

8. $\begin{array}{r} 4372 \\ +6629 \\ \hline \end{array}$

9. $\begin{array}{r} 285 \\ -193 \\ \hline \end{array}$

10. $75\overline{)2625}$

11. Change to lowest terms: $\frac{16}{20}$

12. Change to mixed or whole number: $\frac{30}{5}$

13. Change to mixed or whole number: $\frac{16}{15}$

14. Change to improper fraction: $10\frac{1}{2}$

15. $8 \times \frac{2}{3} =$

16. $4 \times \frac{3}{8} =$

17. $\frac{3}{8} \times \frac{4}{5}$ =

18. $2 \times 1\frac{1}{2}$ =

19. $10\frac{1}{2} \times 3\frac{1}{4}$ =

20. $10 \div 1\frac{1}{2}$ =

21. $\frac{2}{3} \div \frac{3}{4}$ =

22. $100.25 \div 50.5$ =

23. $30.3 \div 3.3$ =

24. $65 \div 0.32$ =

25. $5.63 \div 15$ = _____

26. $140 \times 2.5$ = _____

27. $7.125 \times 0.25$ = _____

28. Change 0.5 to a fraction _____

29. Change 0.04 to a fraction _____

30. Change $\frac{1}{3}$ to a decimal _____

31. Change 0.5% to a decimal _____

32. Change 0.8 to a percent _____

33. Change 5.25 to a percent _____

34. Change 75% to a fraction _____

35. Change $7\frac{1}{2}$% to a decimal _____

36. Change $15\frac{1}{2}\%$ to a fraction _____

37. Change $\frac{4}{5}$ to a percent _____

38. Change $\frac{3}{5}\%$ to a decimal _____

39. Change 4.5 to a percent _____

40. Change $\frac{1}{4}\%$ to a ratio _____

41. Change 1:3 to a percent _____

42. Change 1:2000 to a percent _____

43. Change 1:2000 to a decimal _____

44. Change 0.002 to a ratio _____

45. Change 20% to a ratio _____

46. Change 0.75 to a ratio _____

47. Change 1:4 to a decimal _____

48. Mr. Ash finds that he spends $47.50 for gas for each 1,000 miles that he drives his car. One month he drives his car 1,800 miles. The amount he spent on gas during that month is _____.

49. On a map, the scale is 1" to 80 miles. The actual distance between two cities is 200 miles. The distance between the cities, on the map, is _____.

50. A 25-acre field yields 375 bushels of wheat. How many acres should be planted to yield 525 bushels of wheat? _____

**Check Your Answers on Next Page**

**SOLUTIONS TO EXERCISES, LESSON 1**

1. 2975
   x 36
   17850
   8925
   107100

   (para 1-10)

2. 1566.8
   50)78340.0
   50
   283
   250
   334
   300
   340
   300
   400
   400 (para 1-11)

3. 376
   -107
   269

   (para 1-3)

4. 564
   x 231
   564
   1692
   1128
   130284 (para 1-10)

5. 4791
   + 3208
   7999

   (para 1-2)

6. 4638
   -3135
   1503

   (para 1-3)

7. 121
   6)726
   6
   12
   12
   06
   6 (para 1-11)

8. 4372
   +6629
   11001

   (para 1-2)

9. 285
   -193
   92

   (para 1-3)

10. 35
    75)2625
    225
    375
    375 (para 1-11)

11. $\frac{16}{20} = \frac{4}{5}$

    (para 1-17)

12. $\frac{30}{5} = 6$

    (para 1-18)

13. $\frac{16}{15} = 1\ \frac{1}{15}$

(para 1-18)

14. $10\ \frac{1}{2} = \frac{21}{2}$

(para 1-21)

15. $\frac{8}{1} \times \frac{2}{3} = \frac{16}{3} = 5\ \frac{1}{3}$

(para 1-24)

16. $\frac{4}{1} \times \frac{3}{8} = \frac{12}{8} = 1\ \frac{1}{2}$

(para 1-24)

17. $\frac{3}{8} \times \frac{4}{5} = \frac{12}{40} = \frac{3}{10}$

(para 1-23)

18. $2 \times 1\ \frac{1}{2} = \frac{2}{1} \times \frac{3}{2} = \frac{6}{2} = 3$

(para 1-24)

19. $10\ \frac{1}{2} \times 3\ \frac{1}{4} = \frac{21}{2} \times \frac{13}{4} = \frac{273}{8} = 34\ \frac{1}{8}$

(para 1-25)

20. $10 \div 1\ \frac{1}{2} = \frac{10}{1} \times \frac{2}{3} = \frac{20}{3} = 6\ \frac{2}{3}$

(para 1-26)

21. $\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$

(para 1-26)

22.
```
     1.985
50.5.)100.2.500
      50 5
      49 7 5
      45 4 5
       4 3 00
       4 0 40
         2 600
         2 525
            75
```
(para 1-31)

23.
```
      9.181
3.3.)30.3.000
     29 7
        6 0
        3 3
       2 70
       2 64
         60
         33
         27
```
(para 1-31)

24.
```
     2 03.125
0.32.)65.00.000
      64
       1 0
          0
       1 00
         96
          40
          32
           80
           64
           160
           160
```
(para 1-31)

25. $\begin{array}{r} .375 \\ 15)5.630 \\ \underline{4\ 5} \\ 1\ 13 \\ \underline{1\ 05} \\ 80 \\ \underline{75} \\ 5 \end{array}$ = 0.38

(para 1-31)

26. $\begin{array}{r} 140 \\ \times\ 2.5 \\ \hline 700 \\ \underline{280\ \ } \\ 350.0 \end{array}$

(para 1-34)

27. $\begin{array}{r} 7.125 \\ \times\ 0.25 \\ \hline 35625 \\ \underline{14250\ \ } \\ 1.78125 \end{array}$ = 1.78

(para 1-34)

28. $0.5 = \frac{5}{10} = \frac{1}{2}$

(para 1-35)

29. $0.04 = \frac{4}{100} = \frac{1}{25}$

(para 1-35)

30. $\frac{1}{3} = 1 \div 3 = .33$

(para 1-36)

31. 0.5% = 0.005 (para 1-42)

32. 0.8 = 80% (para 1-43)

33. 5.25 = 525% (para 1-43)

34. $75\% = \frac{75}{100} = \frac{3}{4}$ (para 1-40)

35. $7\frac{1}{2}\% = \frac{15}{2} = 7.5 = .075$ (para 1-42)

36. $15\frac{1}{2}\% = 15\frac{1}{2} = \frac{31}{2} \div \frac{100}{1} = \frac{31}{2} \times \frac{1}{100} = \frac{31}{200}$

(para 1-40)

37. $\frac{4}{5} = 4 \div 5 = .8 = 80\ \%$ (para 1-41)

38. $\frac{3}{5} = 3 \div 5 = .6 = 0.006$

(para 1-42)

39. 4.5 = 450%
(para 1-41)

40. $\frac{1}{4}\% = \frac{1}{\frac{4}{100}} = \frac{1}{4} \div \frac{100}{1} = \frac{1}{4} \times \frac{1}{100} = \frac{1}{400} = 1:400$
(para 1-50)

41. $1:3 = \frac{1}{3} \times \frac{100}{1} = \frac{100}{3} = 33\frac{1}{3}\%$ (para 1-47)

42. $1:2000 = \frac{1}{2000} \times \frac{100}{1} = \frac{100}{2000} = \frac{1}{20}\%$ (para 1-47)

43. $1:2000 = \frac{1}{2000} = 1 \div 2000 = 0.0005$
(para 1-47)

44. $0.002 = \frac{2}{1000} = \frac{1}{500} = 1:500$
(para 1-51)

45. $20\% = .20 = \frac{20}{100} = \frac{1}{5} = 1:5$
(para 1-51)

46. $0.75 = \frac{75}{100} = \frac{3}{4} = 3:4$
(para 1-51)

47. $1:4 = \frac{1}{4} = 1 \div 4 = 0.25$
(para 1-47)

48. 47.50:1000 = X:1800

1000X = 85,500

X = $85.50 (para 1-55)

49. 1:80 = X:200

80X = 200

$X = 2\frac{1}{2}$" or 2.5"
(para 1-55)

50. 25:375 = X = 525

375X = 13,125

X = 35 (para 1-55)

**End of Lesson 1**

## LESSON ASSIGNMENT

**LESSON 2** Pharmacology

**TEXT ASSIGNMENT** Paragraphs 2-1 through 2-34.

**LESSON OBJECTIVES** After completing this lesson, you should be able to:

2-1. Compute medication dosages by the ratio and proportion method.

2-2. Convert from one unit to another, using the metric system, apothecary system, and houshold measurements.

2-3. Compute medication dosages for tablets, pills, and capsules.

2-4. Compute oral medication dosages for prepared strength liquids.

2-5. Compute dosages for parenteral medications.

2-6. Compute dosages for medications manufactured in standardized units.

2-7. Compute medication dosages based on body weight.

2-8. Compute continuous intravenous infusion rates.

2-9. Compute intravenous infusion rates for medication.

2-10. Given a medication label, identify the following information: generic name, trade name, strength of the medication, special storage considerations, and expiration date.

2-11. Given a physician's order for medication administration and the concentration of a drug solution, suspension, or dosage form, calculate the volume of the solution, suspension, tablet, or capsule to be given.

**SUGGESTION** After completing the assignment, complete the exercises at the end of this lesson.

## LESSON 2

## PHARMACOLOGY

## Section I. RATIO AND PROPORTION OPERATIONS

### 2-1. DEFINITIONS

a. **Ratio**.

(1) The relationship of two quantities.

(2) May be expressed as a:

(a) Ratio 1:8, 1:200

(b) Fraction $\frac{1}{8}, \frac{1}{200}$

b. **Proportion**:

The equality of two ratios $\frac{1}{2} = \frac{3}{6}$

### 2-2. CROSS MULTIPLYING

A check as to the equality of two ratios can be made by cross multiplying.

a. Multiply the numerator of the first ratio times the denominator of the second ratio.

b. Then, multiply the denominator of the first ratio times the numerator of the second ratio.

c. If the ratios are the same or equal, the results of the cross multiplication will be the same.

EXAMPLE:

$$\frac{1}{2} = \frac{3}{6}$$

$$\frac{1}{2} \quad \frac{3}{6}$$

(1) $1 \times 6 = 6$

(2) $2 \times 3 = 6$

(3) $6 = 6$ Therefore, the ratios are equal.

## 2-3. "X" AS THE UNKNOWN FACTOR

Because the products of the cross multiplications are always equal in a proportion, if one factor of either ratio is unknown, it may be solved by substituting "X" for the unknown factor in the proportion.

EXAMPLE:

$$\frac{1}{2} = \frac{X}{6}$$

Cross multiply:

$2 (X) = 1 (6)$

$2X = 6$

$$\frac{2X}{2} = \frac{6}{2}$$

$X = 3$

## 2-4. RULES FOR RATIO AND PROPORTION OPERATIONS

a. The numerators must have the same units.

b. The denominators must have the same units.

c. Three of the four variables must be known.

## 2-5. SETTING UP THE PROPORTION

The expression of strength of a medication is usually the first ratio of the proportion, and this ratio is put in proportion to the amount of medication to be administered.

a. Example--If one aspirin tablet contains five grains of aspirin, then how many tablets will you give in order for the patient to receive 15 grains of aspirin?

**NOTE**: The EXPRESSION OF STRENGTH is "one tablet contains five grains of aspirin" and should be written as the first ratio of the proportion.

| IF | THEN |
|---|---|
| 1 tablet / 5 grains = | _____ |

b. Next, assign "X" its proper place in the second proportion. Because the question asks "How many tablets?" the "X" is placed opposite the tablets in the first ratio.

| IF | | THEN |
|---|---|---|
| 1 tablet / 5 grains | = | X tablets |

c. The question asks you to calculate the number of tablets required in order to give 15 grains of aspirin; therefore, the 15 grains will be placed opposite the grains in the first ratio.

| IF | | THEN |
|---|---|---|
| 1 tablet / 5 grains | = | X tablets / 15 grains |

**NOTE**: Prior to cross-multiplying, be sure that corresponding units in each ratio are the same.

## 2-6. SOLVING for "X"

a. You have set up the proportion:

| IF | | THEN |
|---|---|---|
| 1 tablet / 5 grains | = | X tablets / 15 grains |

b. Now, cross multiply:

$$5(X) = 1(15)$$

c. Solve for X:

$$\frac{5X}{5} = \frac{15}{5}$$

$$X = 3$$

d. Refer back to step a. to find the units of X. The units for X in this problem is tablets; therefore, the answer is 3 tablets.

**NOTE**: The most common mistake is the failure to label units. Labeling units will ensure that corresponding units of the proportion are the same.

## 2-7. ROUNDING OFF

a. When rounding answers to the nearest tenth, you must take your calculation out to the hundredth place and then round to the tenth place.

**EXAMPLE**: 3.91 = 3.9

b. When rounding answers to the hundredth place, you must take your calculation out to the thousandth place and then round to the hundredth place.

**EXAMPLE**: 3.846 = 3.85

c. *DO NOT ROUND UNTIL THE LAST STEP OF YOUR CALCULATION!!!!*

## 2-8. PRACTICE 2-1 (RATIO AND PROPORTION)

Round answers to the nearest tenth.

| | On Hand | Doctor's Order | Answer |
|---|---|---|---|
| a. | Mellaril 100 mg/tab | 50 mg. | _____ |
| b. | Gantrisin 0.5 Gm/cc | 2 Gm | _____ |
| c. | Demerol 50 mg/cc | 25 mg | _____ |
| d. | Dilantin 100 mg/cc | 250 mg | _____ |
| e. | Valium 2.5 mg/tab | 15 mg | _____ |
| f. | Ampicillin 0.5 Gm/tsp | 1 Gm | _____ |
| g. | Lincocin 500 mg/0.5 cc | 250 mg | _____ |

| | | |
|---|---|---|
| h. Aldomet 0.1 Gm/cc | 0.15 Gm | _____ |
| i. Atropine gr 1/200/cc | gr 1/300 | _____ |
| j. Digoxin 0.125 mg/0.6 cc | 0.25 mg | _____ |
| k. Vistaril 100 mg/2 cc | 75 mg | _____ |
| l. Morphine 8 mg/cc | 10 mg | _____ |
| m. Polycillin 250 mg/ml | 500 mg | _____ |
| n. Digoxin 0.125 mg/tablet | 0.250 mg | _____ |
| o. Omnipen 125 mg/0.5 ml | 350 mg | _____ |
| p. Kantrex 1 gm/3 ml | 0.5 gm | _____ |
| q. Lanoxin Elixir 0.01 mg/ml | 0.05 mg | _____ |
| r. Lasix 20 mg/ml | 70 mg | _____ |
| s. Dilaudid 2 mg/tablet | 3 mg | _____ |
| t. Robitussin 10 mg/30 ml | 30 mg | _____ |
| u. Ativan 0.5 mg/tablet | 2 mg | _____ |
| v. Luminal 30 mg/tablet | 90 mg | _____ |
| w. Gantrisin 0.25 gm/tablet | 1 gm | _____ |
| x. Cedilanid 0.25 mg/2 cc | 0.5 mg | _____ |
| y. Scopolomine 0.6 mg/2 ml | 0.3 mg | _____ |
| z. Methicillin 500 mg/cc | 750 mg | _____ |

## 2-9. ANSWERS TO PRACTICE 2-1

a. $\frac{1 \text{ tab}}{100 \text{ mg}} = \frac{X \text{ tabs}}{50 \text{ mg}}$

$100 X = 50$

$= \frac{1}{2}$ tab

b. $\frac{1\text{ cc}}{0.5\text{ Gm}} = \frac{X\text{ cc}}{2\text{ Gm}}$

$0.5X = 2$

$X = 4$ cc

c. $\frac{1\text{ cc}}{50\text{ mg}} = \frac{X\text{ cc}}{25\text{ mg}}$

$50X = 25$

$X = .5$ cc

d. $\frac{1\text{ cc}}{100\text{ mg}} = \frac{X\text{ cc}}{250\text{ mg}}$

$100X = 250$

$X = 2.5$ cc

e. $\frac{1\text{ tab}}{2.5\text{ mg}} = \frac{X\text{ tabs}}{15\text{ mg}}$

$2.5X = 15$

$X = 6$ tabs

f. $\frac{1\text{ tsp}}{0.5\text{ Gm}} = \frac{X\text{ tsp}}{1\text{ Gm}}$

$0.5X = 1$

$X = 2$ tsp

g. $\frac{0.5\text{ cc}}{500\text{ mg}} = \frac{X\text{ cc}}{250\text{ mg}}$

$500X = 125$

$X = 0.25 = 0.3$ cc

h. $\frac{1\text{ cc}}{0.1\text{ Gm}} = \frac{X\text{ cc}}{0.15\text{ Gm}}$

$0.1X = 0.15$

$X = 1.5$ cc

i. $\frac{1\text{ cc}}{\text{gr } 1/200} = \frac{X\text{ cc}}{\text{gr } 1/300}$

$\frac{1}{200}X = \frac{1}{300}$

$X = \frac{1}{300} \div \frac{1}{200}$

$X = 0.66 = 0.7$ cc

j. $\frac{0.6\text{ cc}}{0.125\text{ mg}} = \frac{X\text{ cc}}{0.25\text{ mg}}$

$0.125X = .150$

$X = 1.2$ cc

k. $\frac{2\text{ cc}}{100\text{ mg}} = \frac{X\text{ cc}}{75\text{ mg}}$

$100X = 150$

$X = 1.5$ cc

l. $\frac{1\text{ cc}}{8\text{ mg}} = \frac{X\text{ cc}}{10\text{ mg}}$

$8X = 10$

$X = 1.3$ cc

m. $\frac{1\text{ ml}}{250\text{ mg}} = \frac{X\text{ ml}}{500\text{ mg}}$

$250X = 500$

$X = 2$ ml

n. $\frac{1 \text{ tablet}}{0.125 \text{ mg}} = \frac{X \text{ tablets}}{0.250 \text{ mg}}$

$0.125X = 0.250$

$X = 2$ tablets

o. $\frac{0.5 \text{ ml}}{125 \text{ mg}} = \frac{X \text{ ml}}{350 \text{ mg}}$

$125X = 175$

$X = 1.4$ ml

p. $\frac{3 \text{ ml}}{1 \text{ gm}} = \frac{X \text{ ml}}{0.5 \text{ gm}}$

$X = 1.5$ ml

q. $\frac{1 \text{ ml}}{0.01 \text{ mg}} = \frac{X \text{ ml}}{0.05 \text{ mg}}$

$0.01X = 0.05$

$X = 5$ ml

r. $\frac{1 \text{ ml}}{20 \text{ mg}} = \frac{X \text{ ml}}{70 \text{ mg}}$

$20X = 70$

$X = 3.5$ ml

s. $\frac{1 \text{ tablet}}{2 \text{ mg}} = \frac{X \text{ tablets}}{3 \text{ mg}}$

$2X = 3$

$X = 1\frac{1}{2}$ tablets

t. $\frac{30 \text{ ml}}{10 \text{ mg}} = \frac{X \text{ ml}}{30 \text{ mg}}$

$10X = 900$

$X = 90$ ml

u. $\frac{1 \text{ tablet}}{0.5 \text{ mg}} = \frac{X \text{ tablets}}{2 \text{ mg}}$

$0.5X = 2$

$X = 4$ tablets

v. $\frac{1 \text{ tablet}}{30 \text{ mg}} = \frac{X \text{ tablets}}{90 \text{ mg}}$

$30X = 90$

$X = 3$ tablets

w. $\frac{1 \text{ tablet}}{0.25 \text{ gm}} = \frac{X \text{ tablets}}{1 \text{ gm}}$

$0.25X = 1$

$X = 4$ tablets

x. $\frac{2 \text{ cc}}{0.25 \text{ mg}} = \frac{X \text{ cc}}{0.5 \text{ mg}}$

$0.25X = 1.0$

$X = 4$ cc

y. $\frac{2 \text{ ml}}{0.6 \text{ mg}} = \frac{X \text{ ml}}{0.3 \text{ mg}}$

$0.6X = 0.6$

$X = 1$ ml

z. $\frac{1 \text{ cc}}{500 \text{ mg}} = \frac{X \text{ cc}}{750 \text{ mg}}$

$500 X = 750$

$X = 1.5$ cc

## Section II. SYSTEMS OF MEASUREMENT

### 2-10. NOTES

a. **The Metric System.**

(1) Units used in the metric system:

(a) Liter for volume (fluids).

(b) Gram for weight (solids).

(c) Meter for measure (length).

(2) Metric equivalents used in medicine:

(a) Volume--1000 milliliters (ml) = 1 liter (L).

(b) Weight:

1 1000 micrograms (mcg) = 1 milligram (mg).

2 1000 mg = 1 gram (gm).

3 1000 gm = 1 kilogram (kg).

(3) Procedure for conversion from one unit of the metric system to another:

(a) To change milligrams to grams (mg to gm), milliliters to liters (ml to L), or to change grams to kilograms, set up a ratio and proportion based on the equivalent.

**EXAMPLE 1**. Express 50 mg as grams.

50 mg = X gm

$$\frac{1000 \text{ mg}}{1 \text{ gm}} = \frac{50 \text{ mg}}{X \text{ gm}}$$

1000X = 50

X = .05 gm

**EXAMPLE 2**. Express 2200 ml as liters.

$$2200 \text{ ml} = X \text{ L}$$

$$\frac{1000 \text{ ml}}{1 \text{ L}} = \frac{2200 \text{ ml}}{X \text{ L}}$$

$$1000X = 2200$$

$$X = 2.2 \text{ L}$$

(b) To change liters to milliliters, kilograms to grams, grams to milligrams, set up a ratio and proportion based on the equivalent.

**EXAMPLE 1**. Express 3.5 liters as ml.

$$3.5 \text{ L} = X \text{ ml}$$

$$\frac{1 \text{ L}}{1000 \text{ ml}} = \frac{3.5 \text{ L}}{X \text{ ml}}$$

$$X = 3500 \text{ ml}$$

**EXAMPLE 2**. Express 0.5 gm as mg.

$$0.5 \text{ gm} = X \text{ mg}$$

$$\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.5 \text{ gm}}{X \text{ mg}}$$

$$X = 500 \text{ mg}$$

b. **The Apothecaries' System.**

(1) The apothecary system is the original system of medication measurement used by pharmacists and physicians. The system is still in use today to a limited extent. In general, drugs that continue to be ordered and dispensed in apothecary units are those that have been in use for many years. For most other drugs the metric system is the system of measurement commonly used.

(2) Apothecary equivalents to the metric system.

(a) Volume:

1 ounce (oz) = 30 ml
8 oz = 240 ml (approximate)
1 quart (qt) = 1000 ml (approximate) (4 cups)

(b) Weight:

1 grain (gr) = 60 mg
1 oz = 30 gm
2.2 lbs = 1 kg
1000 gm = 1 kg

(3) It is important to understand that the apothecary system is only approximately equivalent to the metric system and to the common household system.

(4) In the apothecary system, fractions and Roman numerals are commonly used to designate numbers. Morphine, for example, may be ordered as 1/4, 1/6, or 1/8 grain. In addition, atropine may be ordered as 1/150 grain or 1/200 grain.

(5) Roman numerals may or may not be capitalized and are often used in combination with "SS", which indicates 1/2. Therefore, the term ISS means 1 1/2, and iiss means 2 1/2.

c. **Household Measure.**

Approximate equivalents to household measure:

1 teaspoon (tsp) = 5 ml
1 tablespoon (tbsp) = 15 ml = 1/2 oz
3 teaspoons (tsp) = 1 tbsp
2 tablespoon (tbsp) = 30 ml = 1 oz

d. **Conversion Between Apothecaries' and Metric Systems.**

(1) Essential equivalents must be learned in order to convert between these two systems.

(2) Ratio and proportion is the easiest way to carry out these conversions.

(3) EXAMPLES:

(a) 45 mg = X gr

$$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{45 \text{ mg}}{X \text{ gr}}$$

$$60X = 45$$

$$X = 3/4 \text{ gr}$$

(b) gr V = X mg

$$\frac{1\text{ gr}}{60\text{ mg}} = \frac{5\text{ gr}}{X\text{ mg}}$$

$$X = 60(5)$$

$$X = 300\text{ mg}$$

(c) 5 tbsp = X ml

$$\frac{1\text{ tbsp}}{15\text{ ml}} = \frac{5\text{ tbsp}}{X\text{ ml}}$$

$$X = 75\text{ ml}$$

(d) 3 oz = X ml

$$\frac{1\text{ oz}}{30\text{ ml}} = \frac{3\text{ oz}}{X\text{ ml}}$$

$$X = 90\text{ ml}$$

(e) 7 lbs = X kg

$$\frac{2.2\text{ lbs}}{1\text{ kg}} = \frac{7\text{ lbs}}{X\text{ kg}}$$

$$2.2X = 7$$

$$X = 3.2\text{ kg}$$

(4) Rules for converting between systems.

(a) All units of measurement must be in the same system, that is, volume to volume, weight to weight.

(b) Label all units of measurement.

(c) BE SURE that the relationship between units is the same on both sides of the equation.

## 2-11. COMMON EQUIVALENTS

| Metric | Apothecary | Household |
|---|---|---|
| 1000 ml = 1 liter | equals approx. 1 quart = 4 cups | 1 quart |
| 500 ml | equals approx. 1 pint = 2 cups | 1 pint |
| 240 ml | equals approx. 8 ounces | 1 cup |
| 30 ml | equals approx. 1 ounce | |

Approximate Common Equivalents

1 tbsp = 15 ml = 1/2 oz
1 tsp = 5 ml = 1/6 oz
3 tsp = 1 tbsp
2 tbsp = 6 tsp = 30 ml = 1 oz
8 oz = 240 ml = 1 cup

2.2 lbs = 1 kg

60 mg = 1 gr
1000 mcg = 1 mg
1000 mg = 1 gm
1000 gm = 1 kg

1 ml = 1 cc
1000 ml = 1 liter

1 unit whole blood = 500 ml
1 unit packed red blood cells = 250 ml

## 2-12. PRACTICE 2-2 (SYSTEMS OF MEASUREMENT)

a. Change the following measures to equivalents within the metric system:

(1) 1000 mg = _____ gm

(2) 500 mg = _____ gm

(3) 200 ml = _____ L

(4) 1500 mg = _____ gm

(5) 0.1 L = _____ ml

(6) 750 mg = _____ gm

(7) 1 kg = _____ gm

(8) 5 L = _____ ml

(9) 4 mg = _____ gm

(10) 100 gm = _____ kg

(11) 0.25 L = _____ ml

(12) 0.0006 gm = _____ mg

(13) 250 mg = _____ gm

(14) 2.5 L = _____ ml

(15) 0.05 gm = _____ mg

(16) 300 mcg = _____ mg

(17) 1 mg = _____ mcg

(18) 0.05 mg = _____ mcg

(19) 4700 ml = _____ L

(20) 0.75 gm = _____ mg

b. Change the following measures to approximate household measures:

(1) 10 ml = _____ tsp

(2) 120 ml = _____ tbsp

(3) 2 oz = _____ tsp

(4) 60 ml = _____ oz

(5) 20 tbsp = _____ oz

(6) 1/2 fl oz = _____ tbsp

(7) 60 ml = _____ tsp

(8) 6 tsp = _____ oz

(9) 1 oz = _____ tsp

(10) 16 tbsp = _____ oz

c. Change the following apothecary measures to the metric equivalent:

(1) gr XV = _____

(2) 6 fl oz = _____

(3) gr 1/6 = _____

(4) gr 1/8 = _____

(5) gr 1/4 = _____

(6) gr 1/10 = _____

(7) 11 lbs = _____

(8) 154 lbs = _____

(9) 8 fl oz = _____

(10) 1 pint = _____

(11) 1 oz = _____

(12) gr X = _____

d. Convert the following units of measure as indicated using the ratio and proportion method.

(1) 45 mg = X gr

(2) 10 ml = X tsp

(3) 5 tbsp = X ml

(4) 500 mcg = X mg

(5) 0.6 gm = X mg

(6) 30 ml = X tbsp

(7) 0.0004 mg = X mcg

(8) 400 mg = X gm

(9) 120 mg = X gr

(10) 400 mcg = X gm

(11) 80 mg = X gr

(12) 10 mg = X gr

(13) 1/4 gr = X mg

(14) 1/6 gr = X mg

## 2-13. ANSWERS TO PRACTICE 2-2 (SYSTEMS OF MEASUREMENT)

a. (1) 1000 mg = 1 gm

(2) 500 mg = .5 gm

(3) 200 ml = .2 L

(4) 1500 mg = 1.5 gm

(5) 0.1 L = 100 ml

(6) 750 mg = .75 gm

(7) 1 kg = 1000 gm

(8) 5 L = 5000 ml

(9) 4 mg = .004 gm

(10) 100 gm = .1 kg

(11) 0.25 L = 250 ml

(12) 0.0006 gm = .6 mg

(13) 250 mg = .25 gm

(14) 2.5 L = 2500 ml

(15) 0.05 gm = 50 mg

(16) 300 mcg = .3 mg

(17) 1 mg = 1000 mcg

(18) 0.05 mg = 50 mcg

(19) 4700 ml = 4.7 L

(20) 0.75 gm = 750 mg

b. (1) $\frac{1 \text{ tsp}}{5 \text{ ml}} = \frac{X \text{ tsp}}{10 \text{ ml}}$

$5X = 10$

$X = 2$ tsp

(2) $\frac{1 \text{ tbsp}}{15 \text{ ml}} = \frac{X \text{ tbsp}}{120 \text{ ml}}$

$15X = 120$

$X = 8$ tbsp

(3) $\frac{1 \text{ tsp}}{1/6 \text{ oz}} = \frac{X \text{ tsp}}{2 \text{ oz}}$

$1/6\ X = 2$

$X = 12$ tsp

(4) $\frac{1 \text{ oz}}{30 \text{ ml}} = \frac{X \text{ oz}}{60 \text{ ml}}$

$30X = 60$

$X = 2$ oz

(5) $\frac{1 \text{ oz}}{2 \text{ tbsp}} = \frac{X \text{ oz}}{20 \text{ tbsp}}$

$2X = 20$

$X = 10$ oz

(6) $\frac{1}{2}$ fl oz = 1 tbsp

(7) $\frac{1 \text{ tsp}}{5 \text{ ml}} = \frac{X \text{ tsp}}{60 \text{ ml}}$

$5X = 60$

$X = 12$ tsp

(8) $\frac{1/6 \text{ oz}}{1 \text{ tsp}} = \frac{X \text{ oz}}{6 \text{ tsp}}$

$X = 1$ oz

(9) 1 oz = 6 tsp

(10) $\frac{1 \text{ oz}}{2 \text{ tbsp}} = \frac{X \text{ oz}}{16 \text{ tbsp}}$

$2X = 16$

$X = 8$ oz

c. (1) $\frac{60 \text{ mg}}{\text{gr } 1} = \frac{X \text{ mg}}{\text{gr } 15}$

$X = 900$ mg

(2) $\frac{30 \text{ ml}}{1 \text{ fl oz}} = \frac{X \text{ ml}}{6 \text{ fl oz}}$

$X = 180$ ml

(3) $\frac{60 \text{ mg}}{\text{gr } 1} = \frac{X \text{ mg}}{\text{gr } \frac{1}{6}}$

$X = 10$ mg

(4) $\frac{60 \text{ mg}}{\text{gr } 1} = \frac{X \text{ mg}}{\text{gr } \frac{1}{8}}$

$X = 7.5$ mg

(5) $\frac{60 \text{ mg}}{\text{gr } 1} = \frac{X \text{ mg}}{\text{gr } \frac{1}{4}}$

$X = 15$ mg

(6) $\frac{60\text{ mg}}{\text{gr } 1} = \frac{X\text{ mg}}{\text{gr } \frac{1}{10}}$

$X = 6$ mg

(7) $\frac{1\text{ kg}}{2.2\text{ lbs}} = \frac{X\text{ kg}}{11\text{ lbs}}$

$2.2X = 11$

$X = 5$ kg

(8) $\frac{1\text{ kg}}{2.2\text{ lbs}} = \frac{X\text{ kg}}{154\text{ lbs}}$

$2.2X = 154$

$X = 70$ kg

(9) $\frac{30\text{ ml}}{1\text{ fl oz}} = \frac{X\text{ ml}}{8\text{ fl oz}}$

$X = 240$ ml

(10) 1 pt = 500 ml

(11) 1 oz = 30 ml

(12) $\frac{60\text{ mg}}{\text{gr } 1} = \frac{X\text{ mg}}{\text{gr } 10}$

$X = 600$ mg

d. (1) $45\text{ mg} = \underline{X}\text{ gr}$

$\frac{60\text{ mg}}{1\text{ gr}} = \frac{45\text{ mg}}{X\text{ gr}}$

$60X = 45$

$X = 3/4$ gr

(2) 10 ml = X tsp

$$\frac{5 \text{ ml}}{1 \text{ tsp}} = \frac{10 \text{ ml}}{X \text{ tsp}}$$

$5X = 10$

$X = 2$ tsp

(3) 5 tbsp = X ml

$$\frac{1 \text{ tbsp}}{15 \text{ ml}} = \frac{5 \text{ tbsp}}{X \text{ ml}}$$

$X = 75$ ml

(4) 500 mcg = X mg

$$\frac{1000 \text{ mcg}}{1 \text{ mg}} = \frac{500 \text{ mcg}}{X \text{ mg}}$$

$1000X = 500$

$X = .5$ mg

(5) 0.6 gm = X mg

$$\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.6 \text{ gm}}{X \text{ mg}}$$

$X = 600$ mg

(6) 30 ml = X tbsp

$$\frac{15 \text{ ml}}{1 \text{ tbsp}} = \frac{30 \text{ ml}}{X \text{ tbsp}}$$

$15X = 30$

$X = 2$ tbsp

(7) 0.0004 mg = X mcg

$$\frac{1 \text{ mg}}{1000 \text{ mcg}} = \frac{0.0004 \text{ mg}}{X \text{ mcg}}$$

X = .4 mcg

(8) 400 mg = X gm

$$\frac{1000 \text{ mg}}{1 \text{ gm}} = \frac{400 \text{ mg}}{X \text{ gm}}$$

1000X = 400

X = .4 gm

(9) 120 mg = X gr

$$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{120 \text{ mg}}{X \text{ gr}}$$

60X = 120

X = 2 gr

(10) 400 mcg = X gm

$$\frac{1{,}000{,}000 \text{ mcg}}{1 \text{ gm}} = \frac{400 \text{ mcg}}{X \text{ gm}}$$

1,000,000X = 400

X = .0004 gm

(11) 80 mg = X gr

$$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{80 \text{ mg}}{X \text{ gr}}$$

60X = 80

X = 1 1/3 gr

(12) 10 mg = X gr

$$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{10 \text{ mg}}{X \text{ gr}}$$

$60X = 10$

$X = \frac{1}{6 \text{ gr}}$

(13) 1/4 gr = X mg

$$\frac{1 \text{ gr}}{60 \text{ mg}} = \frac{1/4 \text{ gr}}{X \text{ mg}}$$

X = 15 mg

(14) 1/6 gr = X mg

$$\frac{1 \text{ gr}}{60 \text{ mg}} = \frac{1/6 \text{ gr}}{X \text{ mg}}$$

X = 10 mg

## Section III. COMPUTING MEDICATION DOSAGES

### 2-14. INFORMATION REQUIRED IN EVERY PHYSICIAN'S MEDICATION ORDER

a. Date and time the order is written.

b. Name of the medication.

c. Dosage of the medication.

d. Directions for administration.

(1) Route:

(a) I.M.: intramuscular or intramuscularly.

(b) I.V.: intravenous or intravenously.

(c) P.O. or p.o.: by mouth.

(d) p.r.: per rectum or rectally.

(e) SC (or SQ): subcutaneous or subcutaneously.

(2) Time interval or frequency:

(a) q 4h: every 4 hours.

(b) b.i.d.: twice a day.

(c) p.r.n.: if needed, as needed.

(d) q.d.: every day, daily.

(e) q.i.d.: 4 times a day.

(f) q.o.d.: every other day.

(g) t.i.d.: 3 times a day.

## 2-15. FIVE "RIGHTS" OF MEDICATION ADMINISTRATION

a. The right patient.

b. The right drug.

c. The right dose.

d. The right route.

e. The right time.

## 2-16. COMPUTING DOSAGES FOR TABLETS, PILLS, AND CAPSULES

**EXAMPLE**: You are to give 0.5 gm of medication to a patient P.O. On hand are 250 mg capsules.

a. Set up the proportion. LABEL ALL UNITS.

$$\frac{1 \text{ capsule}}{250 \text{ mg}} = \frac{X \text{ capsules}}{0.5 \text{ gm}}$$

b. Convert the strength of the medication ordered and the strength of the medication stocked to the same unit of measurement.

0.5 gm = X mg

$$\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.5 \text{ gm}}{X \text{ mg}}$$

X = 500 mg

c. Cross-multiply.

$$\frac{1 \text{ capsule}}{250 \text{ mg}} = \frac{X \text{ capsules}}{500 \text{ mg}}$$

$250X = 500$

d. Solve for "X." Label the answer.

$X = 2$ capsules

**EXAMPLE**: You are to give Ampicillin 375 mg P.O. Ampicillin is stocked in 250 mg scored tablets.

$$\frac{1 \text{ tablet}}{250 \text{ mg}} = \frac{X \text{ tablets}}{375 \text{ mg}}$$

$250 X = 375$

$X = 1\ 1/2$ tablets

**PRACTICE**: Try this one yourself. Then refer to the solution provided to check your work.

You are to administer phenobarbital gr 1/2 P.O. to a patient. On hand are 15 mg tablets.

**SOLUTION**:

$$\frac{1 \text{ tablet}}{15 \text{ mg}} = \frac{X \text{ tablets}}{\text{gr } 1/2}$$

$$\frac{\text{gr } 1}{60 \text{ mg}} = \frac{\text{gr } 1/2}{X \text{ mg}}$$

$$\frac{60 \text{ mg}}{\text{gr } 1} = \frac{X \text{ mg}}{\text{gr } 1/2}$$

$X = 30$ mg

$$\frac{1 \text{ tablet}}{15 \text{ mg}} = \frac{X \text{ tablets}}{30 \text{ mg}}$$

$15 X = 30$

$X = 2$ tablets

e. Round dosages for tablets, pills, and capsules to the whole or half.

## 2-17. COMPUTING DOSAGES FOR ORAL LIQUID MEDICATIONS (PREPARED-STRENGTH LIQUIDS)

**NOTE**: Remember that the size (total # of mls) of the bottle of medication has no influence on the Expression of Strength of the medication.

**EXAMPLE #1**: You are to give 125 mg of a liquid medication to a patient. The medication is stocked in a 100 ml bottle that contains 250 mg of the medication per 5 ml.

a. Set up the proportion. *LABEL ALL UNITS*.

$$\frac{250 \text{ mg}}{5 \text{ ml}} = \frac{125 \text{ mg}}{X \text{ ml}}$$

b. Convert the strength of the medication ordered and the strength of the medication stocked to the same unit of measurement.

(not applicable here)

c. Cross-multiply.

$250X = 725$

d. Solve for "X." Label the answer.

$X = 2.5$ ml

**EXAMPLE #2**: Administer ampicillin 125 mg P.O. to a pediatric patient. On hand is a 100 ml bottle of ampicillin suspension labeled 0.2 gm per 4 ml. How many ml will you give?

a. Set up the proportion. *LABEL ALL UNITS*.

$$\frac{0.2 \text{ gm}}{4 \text{ ml}} = \frac{125 \text{ mg}}{X \text{ ml}}$$

b. Convert the strength of the medication ordered and the medication stocked to the same unit of measurement.

$$\frac{1\text{ gm}}{1000\text{ mg}} = \frac{0.2\text{ gm}}{X\text{ mg}}$$

X = 200 mg

$$\frac{200\text{ mg}}{4\text{ ml}} = \frac{125\text{ mg}}{X\text{ ml}}$$

c. Cross-multiply.

200X = 500

d. Solve for "X." Label the answer.

X = 2.5 ml

**NOTE**: Round P.O. liquids to the nearest tenth place.

**PRACTICE**: The physician has ordered KCL 40 mEq P.O. for your patient. On hand is KCL 15 mEq per 5 ml. How many ml will you administer?

**SOLUTION**:

$$\frac{15\text{ mEq}}{5\text{ ml}} = \frac{40\text{ mEq}}{X\text{ ml}}$$

15X = 200

X = 13.3 = 13.3 ml

**PRACTICE**: The physician's order reads: Tylenol elixir gr V P.O. q 4h p.r.n. for pain. The medication label reads: Tylenol elixir 60 mg per 0.5 ml. How many ml will you administer?

**SOLUTION**:

$$\frac{60 \text{ mg}}{0.5 \text{ ml}} = \frac{5 \text{ gr}}{X \text{ ml}}$$

$$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{X \text{ mg}}{5 \text{ gr}}$$

X = 300 mg

$$\frac{60 \text{ mg}}{0.5 \text{ ml}} = \frac{300 \text{ mg}}{X \text{ ml}}$$

60X = 150

X = 2.5 ml

## 2-18. COMPUTING DOSAGE FOR PARENTERAL MEDICATIONS

a. **Parenteral Medication Calculations.** The procedure for computing parenteral medication dosages is the same as for oral liquid medications (prepared strength liquids).

**EXAMPLE**: The order is to give Demerol (meperidine) 35 mg I.M. q4h p.r.n. for pain. The medication is supplied in an ampule marked 50 mg per ml. How much of the medication should you give?

(1) Set up the proportion. Label all units.

$$\frac{50 \text{ mg}}{1 \text{ ml}} = \frac{35 \text{ mg}}{X \text{ ml}}$$

(2) Convert the strength of the medication ordered and the strength of the medication stocked to the same unit of measurement.

(not applicable here)

(3) Cross-multiply.

50X = 35

(4) Solve for "X." Label answers.

X = .7 ml

**NOTE**: Round parenteral medications to the tenth, except for heparin and insulin, which are rounded to the hundredth.

**PRACTICE**: The order is to give morphine sulfate gr 1/8 I.M. q 4h p.r.n. for pain. On hand are ampules labeled 10 mg per ml. How much medication should you give?

**SOLUTION**:

$$\frac{10\ mg}{1\ ml} = \frac{\frac{1}{8}\ gr}{X\ ml}$$

$$\frac{60\ mg}{1\ gr} = \frac{X\ mg}{\frac{1}{8}\ gr}$$

X = 7.5 mg

$$\frac{10\ mg}{1\ ml} = \frac{7.5\ mg}{X\ ml}$$

10X = 7.5

X = .75 = .8 ml

**PRACTICE**: The order is to give 0.3 mg of atropine I.M. on call to surgery. The medication is stocked in a vial labeled gr 1/150 per ml. How much medication should you give?

**SOLUTION**:

$$\frac{gr\ 1/150}{1\ ml} = \frac{0.3\ mg}{X\ ml}$$

$$\frac{60\ mg}{gr\ 1} = \frac{X\ mg}{gr\ 1/150}$$

X = .4 mg

$$\frac{.4\ mg}{1\ ml} = \frac{0.3\ mg}{X\ ml}$$

.4 X = 0.3

X = .75 = .8 ml

**PRACTICE**: The physician orders Gentamicin 60 mg I.M. q 8h. The vial is labeled 80 mg per 2 ml. How much medication should you give?

**SOLUTION**:

$$\frac{80 \text{ mg}}{2 \text{ ml}} = \frac{60 \text{ mg}}{X \text{ ml}}$$

$$80X = 120$$

$$X = 1.5 \text{ ml}$$

b. **Reconstitution of Medications for Injection.**

(1) Some medications will become unstable in solution over time. You may see these medications manufactured as dry powders.

(2) Prior to administration of these medications, an appropriate diluent (sterile water, normal saline, and so forth) must be added. The term used to describe the process of adding the diluent to the medication is reconstitution.

(3) Usually the volume of the diluent is expanded somewhat when added to the dry powder. For example, when 2 ml of diluent are added to a dry vial of 1 gram of Mefoxin, the resulting withdrawable volume is 2.5 ml.

(4) The directions for reconstitution of a medication may list a number of different amounts of diluent, each resulting in a different concentration. If that is the case, choose a concentration, which would provide an appropriate volume for the injection. When selecting a concentration, keep in mind that no more than 3-4 ml should be injected into one I.M. site. However, it may be necessary to divide the dose and inject it into two different sites.

**EXAMPLE**: The order is to give 300,000 units of Penicillin G Potassium I.M. A concentration of 200,000 units/ml should be used. The medication on hand is in a 1,000,000 unit vial. How many ml will you give? (Directions for reconstitution are listed below.)

1,000,000 unit vial:

| Concentration | Diluent to be Added |
|---|---|
| 100,000 units/ml | 9.6 ml |
| 200,000 units/ml | 4.6 ml |
| 250,000 units/ml | 3.6 ml |

**NOTE**: Figure 2-1 below illustrates the process of reconstitution of the medication in this example.

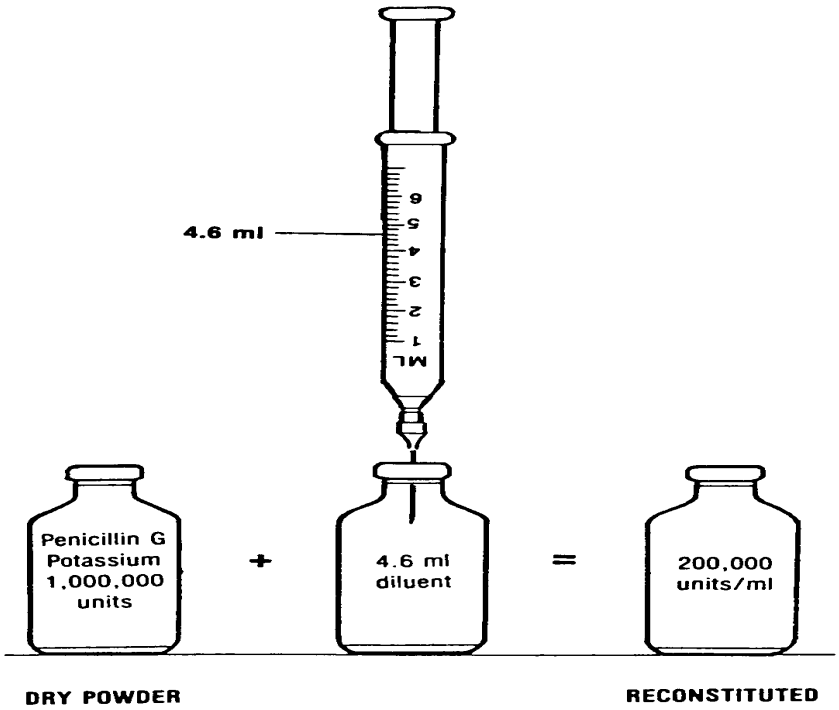



Figure 2-1. The process of reconstitution.

(a) Set up the proportion. Label all units.

$$\frac{200{,}000 \text{ units}}{1 \text{ ml}} = \frac{300{,}000 \text{ units}}{X \text{ ml}}$$

(b) Cross-multiply.

$200{,}000X = 300{,}000$

(c) Solve for X. Label answer.

$X = 1.5$ ml

**PRACTICE**: The physician has ordered 0.5 gm of Mefoxin I.M. b.i.d. You have a 1 gm vial available. Directions for reconstitution are:

| Concentration | Amount of Diluent | Withdrawable Volume |
|---|---|---|
| 400 mg/ml | 2 ml for I.M. use | 2.5 ml |
| 95 mg/ml | 10 ml for I.V. use | 10.5 ml |

1 Which concentration should be used?

2 How many ml should be administered?

a Set up the proportion. Label all units.

b. Convert the strength of the medication ordered and the strength of the medication stocked to the same unit of measurement.

c. Cross-multiply.

d. Solve for X. Round off to the nearest tenth. Label answer.

**SOLUTION**:

1. 400 mg/ml

2. a. $\frac{400\text{ mg}}{1\text{ ml}} = \frac{0.5\text{ gm}}{X\text{ ml}}$

   b. $\frac{1\text{ gm}}{1000\text{ mg}} = \frac{0.5\text{ gm}}{X\text{ mg}}$

   $X = 500\text{ mg}$

   $\frac{400\text{ mg}}{1\text{ ml}} = \frac{500\text{ mg}}{X\text{ ml}}$

   c. $400X = 500$

   d. $X = 1.25 = 1.3\text{ ml}$

**PRACTICE**: The order is to give Cleocin Phosphate 300 mg I.V. Directions for reconstitution state: Add 50 ml of sterile water. Each ml will contain 12 mg of medication. How many ml will you give?

**SOLUTION**:

$\frac{1\text{ ml}}{12\text{ mg}} = \frac{X\text{ ml}}{300\text{ mg}}$

$12X = 300$

$X = 25\text{ ml}$

c. **Heparin Calculations.**

(1) Heparin is supplied in various concentrations, labeled in units per ml.

(2) It is administered subcutaneously or intravenously.

(3) All heparin calculations should be carried out to the thousandth decimal place and rounded to the hundredth place.

(4) Subcutaneous injections of heparin should be administered using a tuberculin syringe.

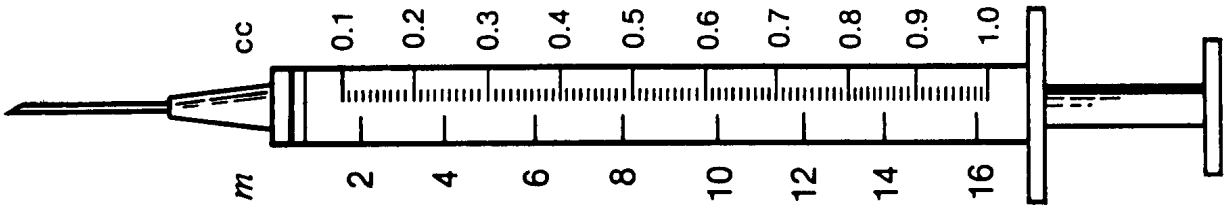



Figure 2-2. Tuberculin (T.B.) syringe.

**EXAMPLE**: The physician has ordered heparin 5,000 units SC q 8h. Using a vial labeled 40,000 units per ml, calculate the amount of heparin to give.

(a) Set up the proportion. Label all units.

$$\frac{40{,}000 \text{ units}}{1 \text{ ml}} = \frac{5{,}000 \text{ units}}{X \text{ ml}}$$

(b) Cross-multiply.

40,000X = 5,000

X = 0.125 ml

Give 0.13 ml

**PRACTICE**: The order is for 15,000 units of heparin SC q 12h. You have a vial labeled 20,000 units per ml. How much medication will you give?

**SOLUTION**:

$$\frac{20{,}000 \text{ units}}{1 \text{ ml}} = \frac{15{,}000 \text{ units}}{X \text{ ml}}$$

20,000X = 15,000

X = 0.75 ml

**PRACTICE**: The order is to give heparin 11,000 units SC q 8h. Available is a vial containing 20,000 units per ml. How much medication will you give?

**SOLUTION**:

$$\frac{20{,}000 \text{ units}}{1 \text{ ml}} = \frac{11{,}000 \text{ units}}{X \text{ ml}}$$

$20{,}000X = 11{,}000$

$X = 0.55$ ml

d. **Insulin Calculations.**

(1) Insulin is supplied in 10 ml vials labeled in the number of units per ml. U-100 insulin is the most commonly used concentration.

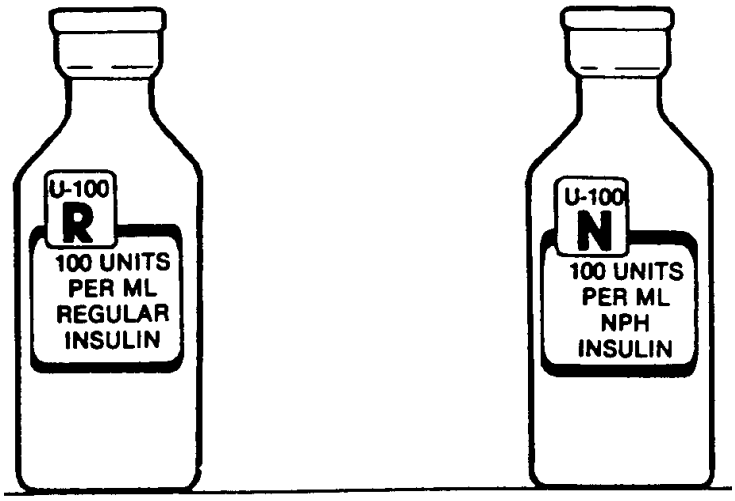



Figure 2-3. U-100 insulin.

(2) The simplest and most accurate way to measure insulin is with an insulin syringe. An insulin syringe is calibrated in units and the ordered dose is read directly on the syringe. Therefore, to measure 16 units of U-100 insulin, you would simply measure to the 16 unit mark on the U-100 insulin syringe.

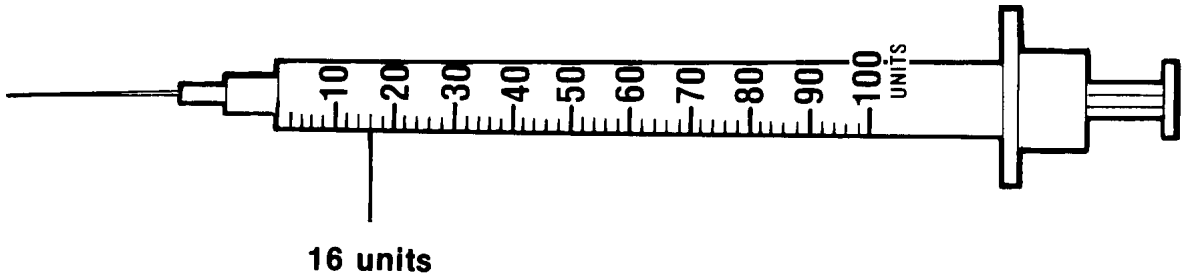



Figure 2-4. Measuring insulin in an insulin syringe.

(3) When measuring U-100 insulin (100 units per ml) in a 1 ml tuberculin syringe, the number of units ordered will always equal an equivalent number of hundredths of a milliliter. Therefore, to measure 16 units of U-100 insulin, measure to the 0.16 ml mark on the tuberculin syringe. Be sure to use the cc scale on the syringe.

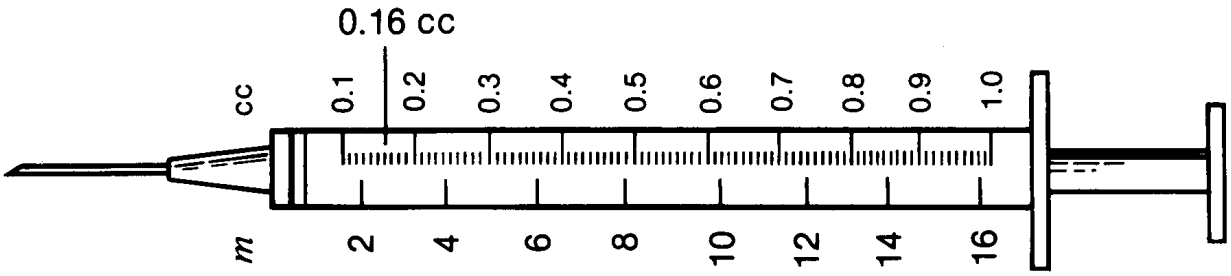



Figure 2-5. Measuring insulin in a tuberculin syringe.

(4) Calculations for insulin dosages are carried out in the same manner as for other parenteral medications. However, as with heparin, all insulin calculations should be rounded to the hundredth place.

**EXAMPLE**: The order is to give 20 units of Regular Insulin. You are using U-100 insulin and a tuberculin syringe. What is the required dose?

$$\frac{100 \text{ units}}{1 \text{ ml}} = \frac{20 \text{ units}}{X \text{ ml}}$$

$$100X = 20$$

$$X = 0.2 \text{ ml}$$

**PRACTICE**: The order is to give 30 units of NPH insulin SC. Available is a 10 ml vial labeled U-100 NPH insulin. Calculate the amount of insulin to give.

**SOLUTION**:

$$\frac{100 \text{ units}}{1 \text{ ml}} = \frac{30 \text{ units}}{X \text{ ml}}$$

$$100X = 30$$

$$X = 0.3 \text{ ml}$$

e. **Calculation of Medication Based on Body Weight.** Medication doses are often based on the patient's body weight, especially with infants and children. Although this is primarily a professional responsibility, you may use the manufacturer's recommendations to determine if a prescribed dose is a reasonable dose to administer.

**EXAMPLE #1**: The manufacturer's recommendation for pediatric Tylenol is 10 mg/kg/dose. How many mg are recommended for each dose for a 20 kg child?

Calculate the dosage (mg) of Tylenol the child is to receive, using the proportion method.

$$\frac{10 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{20 \text{ kg}}$$

1 X = 200 mg/dose for 20 kg child

**EXAMPLE #2**: The recommendation for Garamycin is 2 mg/kg/dose. The child weighs 15 kg. The Garamycin is supplied 10 mg/ml. How many mg are recommended for each dose for a 15 kg child? How many ml are required for a single dose?

a. Calculate the dosage (mg) of Garamycin to be given to the 15kg child for <u>one</u> <u>dose</u>.

$$\frac{2 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{15 \text{ kg}}$$

1 X = 30 mg for the 15 kg child.

b. Calculate the amount (ml) of Garamycin to be given for one dose.

$$\frac{10 \text{ mg}}{1 \text{ ml}} = \frac{30 \text{ mg}}{X \text{ ml}}$$

10 X = 30

X = 3 ml

Therefore, 3 ml will provide the recommended dose for a 15 kg child.

**PRACTICE #1**: A patient who weighs 154 pounds is to receive a medication that has a recommended one time dosage of 3 mg/kg. The medication is stocked in a vial labeled 50 mg/ml. Calculate the volume of the medication to be administered.

a. Convert the patient's body weight to kilograms.

$$\frac{1 \text{ kg}}{2.2 \text{ lbs}} = \frac{X \text{ kg}}{154 \text{ lbs}} \qquad 2.2\,X = 154 \qquad X = 70 \text{ kg}$$

b. Calculate the dosage of the medication based on the patient's body weight.

$$\frac{3 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{70 \text{ kg}}$$

$$1X = 210 \text{ mg}$$

c. Calculate the volume of the drug to be administered.

**SOLUTION TO c**.:

$$\frac{50 \text{ mg}}{1 \text{ ml}} = \frac{210 \text{ mg}}{X \text{ ml}}$$

$$50X = 210$$

$$X = 4.2 \text{ ml}$$

**PRACTICE #2**: The order is for Depakene 15mg/kg/day for a patient who weighs 110 pounds. The medication is to be given in 3 divided doses. Depakene is stocked in 125 mg/capsules. Calculate the number of capsules to give per dose.

**SOLUTION**:

a. Convert the patient's body weight to kilograms.

$$\frac{1 \text{ kg}}{2.2 \text{ lbs}} = \frac{X \text{ kg}}{110 \text{ lbs}}$$

$$2.2X = 110$$

$$X = 50 \text{ kg}$$

b. Calculate the dosage (per day) of medication based on the patient's body weight.

$$\frac{15 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{50 \text{ kg}}$$

X = 750 mg per day

c. Calculate the number of capsules to be administered per day.

$$\frac{125 \text{ mg}}{1 \text{ capsule}} = \frac{750 \text{ mg}}{X \text{ capsules}}$$

125X = 750

X = 6 capsules per day

d. Calculate the number of capsules to be administered per dose.

6 ÷ 3 = 2 capsules per dose.

## 2-19. MODIFIED PROPORTION METHOD FOR COMPUTING DOSAGES

**NOTE**: The final examination at the end of the subcourse will not include information from paragraph 2-19. This alternative method of computing dosages is for your information only.

$$\frac{D}{H} \times Q \qquad \frac{\text{Desired Dose} \times \text{Quantity}}{\text{On Hand Dose}}$$

**PRACTICE**: You are to administer 300 mg of a medication to a patient. The medication is stocked in a vial labeled 250 mg per 2.5 ml. How many ml will you administer?

**SOLUTION**:

$$\frac{300 \text{ mg}}{250 \text{ mg}} \times 2.5 \text{ ml} = \frac{750}{250} = 3 \text{ ml}$$

## 2-20. PRACTICE 2-3 (COMPUTING MEDICATION DOSAGES)

1. You are to administer Dilantin 300 mg P.O. to a patient. Dilantin is stocked in 100 mg capsules. You will administer ____capsules.

2. Aspirin tablets are labeled 0.3 gm. How many tablets are needed for a dose of 600 mg?_____

3. The doctor has ordered Diabinese tablets 0.25 gm for your patient. You have available Diabinese 100 mg tablets. You will administer _____ tablets to your patient.

4. You are to administer Digoxin 0.375 mg P.O. to a patient. On hand are 0.25 mg tablets. You will administer _____ tablets.

5. You are to administer Phenobarbital gr 1/4 P.O. to a patient. On hand are 15 mg tablets. How many tablets will you give? _____

6. Your patient is to receive Digoxin 0.25 mg P.O. You have available a bottle labeled 0.05 mg per 1 ml. You will administer ___ ml to your patient.

7. The doctor has ordered Mellaril liquid 0.1 gm for your patient. You have available Mellaril liquid labeled 30 mg/ml. You will administer ____ ml to your patient.

8. The physician's order is KCL 40 mEq P.O. On hand is KCL 15 mEq per 5 ml. You will administer _____ml.

9. Administer Ampicillin 125 mg P.O. to a pediatric patient. On hand is a 100 ml bottle of Ampicillin suspension containing 200 mg per 4 ml. How many ml will you give? _____

10. The order reads: Tylenol elixir gr X P.O., p.r.n. for pain. The medication label reads: Tylenol elixir 60 mg per 0.5 ml. You will administer _____ ml.

11. The physician has ordered Ritalin 30 mg P.O. t.i.d. On hand are 20 mg scored tablets. How many tablets will you give? _____

12. The order is for Mysoline 125 mg P.O. t.i.d. On hand are 250 mg tablets. How many tablets will you give per dose? _____ per day?_____

13. You are to give the patient Ampicillin 250 mg P.O. q 6h. The suspension on hand contains 125 mg per 5 ml. How many ml will the patient receive per dose? _____

14. The order is to give Dilantin 100 mg P.O. t.i.d. The available suspension contains 30 mg per 5 ml. How many ml. will you give?_____

15. The physician has ordered Tetracycline syrup 500 mg q 6h P.O. The available medication contains 125 mg per 5 ml. How many ml will you give? _____

16. The doctor has ordered 65 mg of Garamycin I.M. for your patient. You have available a multidose vial of Garamycin labeled 40 mg/ml. How much of the medication will the patient receive? _____

17. The doctor has ordered an injection of Atropine 0.3 mg I.M. for your patient. You have available a multi-dose vial labeled Atropine 1 mg/ml. You will administer _____ ml to your patient.

18. The doctor orders Morphine gr 1/4 I.M. for your patient. You have available Morphine 10 mg/ml. How much of the solution will you administer? _____

19. The doctor has ordered Digoxin 0.125 mg I.M. You have a vial of Digoxin labeled 0.5 mg/2 ml. How much of the medication should the patient receive? _____

20. You are to administer Atropine gr 1/200 I.M. to a patient. On hand is Atropine gr 1/150 per 0.8 ml. How many ml will you give?_____

21. The vial of powdered medication is labeled Staphcillin 1 gm. The directions say to add 1.5 ml of sterile saline. The solution will then equal 2 ml. How much of the solution should you give if the order is Staphcillin 500 mg I.M.? _____

22. The doctor has ordered Keflin 250 mg I.M. for a 5-year-old patient. You have available a vial of powdered drug labeled 1 gm Keflin. You read the manufacturer's directions and find you should add 4 ml of sterile water to dissolve the drug and produce a solution in which 2.2 ml equals 500 mg of Keflin. How many ml will you give?_____

23. The doctor has ordered Regular Insulin 46 units SC for your patient. Using Regular Insulin U-100, how many ml will you administer if the medication is drawn up in a tuberculin syringe? _____

24. You are to give 20 u of Regular Insulin. You have U-40 Regular Insulin available. How much will you give using a tuberculin syringe? _____

25. The physician has ordered Heparin 2000u SC for your patient. On hand is a 20 ml vial of Heparin labeled 10,000u per ml. You will give _____ ml.

26. The order is to give Prostaphlin 350 mg I.M. q 4h. Directions for reconstitution of the 1 gm vial state: Add 5.7 ml of sterile water. Each 1.5 ml will then contain 250 mg of medication. How many ml will you give? ___

27. The order is to give 0.25 gm Cefobid I.M. q 12h. Directions for reconstitution of the 1 gm vial state: Add 2.8 ml of sterile water to produce a concentration of 333 mg. per ml. How many ml will you give? _____

28. The order is to give Pipracil 750 mg I.M. q 8h. Directions for reconstitution of the 2 gm vial state: Add 4 ml of sodium chloride to produce a concentration of 1 gm per 2.5 ml. How many ml will you give?_____

29. The following refers to reconstitution of penicillin:

| Diluent | = | Concentration |
|---|---|---|
| 3.2 ml | = | 1,000,000 units/ml |
| 8.2 ml | = | 500,000 units/ml |
| 18.2 ml | = | 250,000 units/ml |

Using the 3.2 diluent, how much penicillin (ml) must be used to administer 1.5 million units? (1.5 million = 1,500,000)

30. The recommended dose of Penicillin G is 250,000 units/kg/day divided in 6 equal doses. The medication is available as 1,000,000 units per 10 ml. The child weighs 30 kg. Determine the number of ml to be administered per dose. _____.

31. The doctor has ordered 2000 units of Heparin SC. You have available a 5 ml vial labeled 10,000 units per ml. How many ml will you administer? _____

32. The order is to give Penicillin G 300,000 units I.M. for your patient. You have a vial that contains 200,000 units/ml. How much medication will you administer? _____

33. The order is to give Atropine gr 1/200 I.M. On hand is an ampule labeled gr 1/150 per 2 ml. How many ml will you give? _____

34. The order is to give Morphine 6 mg I.M. q 4h, p.r.n. The available vial is labeled 1/6 gr per ml. How many ml will you give?_____

35. The order is to give Phenobarbital gr 1/4 I.M., q 4-6 h p.r.n. On hand is a tubex (prefilled syringe) labeled 30 mg/2 ml. How many ml will you give? _____

36. The order is to give Methicillin 0.6 gm I.M. q 6h. On hand is a vial labeled 150 mg per ml. How many ml should you give? _____

37. The order is to give Mylanta 45 ml P.O. q 2h. How many ounces will you administer? _____

38. The order is to give Erythromycin base 0.5 gm P.O. q 6h. On hand are 125 mg tablets. How many tablets will you give? _____

39. The physician has ordered Synthroid 25 mcg P.O. q AM. Available are 0.05 mg tablets. How many tablets will you give?_____

40. The order is for Slophyllin 60 mg P.O. q 8h. The medication is supplied in a syrup 80 mg/15 ml. How many ml will you give?_____

## 2-21. ANSWERS TO PRACTICE 2-3 (COMPUTING MEDICATION DOSAGES)

1. $\frac{1 \text{ capsule}}{100 \text{ mg}} = \frac{X \text{ capsules}}{300 \text{ mg}}$

   $100 X = 300$

   $X = 3$ capsules (paras 2-2, 2-3, 2-16)

2. (a) $\frac{1 \text{ tablet}}{0.3 \text{ gm}} = \frac{X \text{ tablets}}{600 \text{ mg}}$

   (b) 0.3 gm = X mg

   $\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.3 \text{ gm}}{X \text{ mg}}$

   $X = 300$ mg

   (c) $\frac{1 \text{ tablet}}{300 \text{ mg}} = \frac{X \text{ tablets}}{600 \text{ mg}}$

   $300 X = 600$

   $X = 2$ tablets (paras 2-2, 2-3, 2-7, 2-16)

3. (a) $\frac{1 \text{ tablet}}{100 \text{ mg}} = \frac{X \text{ tablets}}{0.25 \text{ gm}}$

   (b) 0.25 gm = X mg

   $\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.25 \text{ gm}}{X \text{ mg}}$

   $X = 250$ mg

   (c) $\frac{1 \text{ tablet}}{100 \text{ mg}} = \frac{X \text{ tablets}}{250 \text{ mg}}$

   $100 X = 250$

   $X = 2.5$ or 2 1/2 tablets (paras 2-2, 2-3, 2-7, 2-16)

4. $\frac{\text{1 tablet}}{\text{0.25 mg}} = \frac{\text{X tablets}}{\text{0.375 mg}}$

   0.25 X = 0.375

   X = 1.5 or 1 1/2 tablets (paras 2-2, 2-3, 2-16)

5. (a) $\frac{\text{1 tablet}}{\text{15 mg}} = \frac{\text{X tablets}}{\text{gr 1/4}}$

   (b) $\frac{\text{gr 1}}{\text{60 mg}} = \frac{\text{gr 1/4}}{\text{X mg}}$

   X = 15 mg

   (c) $\frac{\text{1 tablet}}{\text{15 mg}} = \frac{\text{X tablets}}{\text{15 mg}}$

   15 X = 15

   X = 1 tablet (paras 2-2, 2-3, 2-7, 2-16)

6. $\frac{\text{0.05 mg}}{\text{1 ml}} = \frac{\text{0.25 mg}}{\text{X ml}}$

   0.05 X = 0.25

   X = 5 ml (para 2-14)

7. (a) $\frac{\text{30 mg}}{\text{1 ml}} = \frac{\text{0.1 gm}}{\text{X ml}}$

   (b) 0.1 gm = X mg

   $\frac{\text{1 gm}}{\text{1000 mg}} = \frac{\text{0.1 gm}}{\text{X mg}}$

   X = 100 mg

   (c) $\frac{\text{30 mg}}{\text{1 ml}} = \frac{\text{100 mg}}{\text{X ml}}$

   30 X = 100

   X = 3.3 ml (paras 2-2, 2-3, 2-7, 2-17)

8. $\frac{15 \text{ mEq}}{5 \text{ ml}} = \frac{40 \text{ mEq}}{X \text{ ml}}$

   $15 X = 200$

   $X = 13.3$ ml (paras 2-2, 2-3, 2-17)

9. $\frac{200 \text{ mg}}{4 \text{ ml}} = \frac{125 \text{ mg}}{X \text{ ml}}$

   $200 X = 500$

   $X = 2.5$ ml (paras 2-2, 2-3, 2-17)

10. (a) $\frac{60 \text{ mg}}{0.5 \text{ ml}} = \frac{\text{gr } 10}{X \text{ ml}}$

    (b) gr 10 = X mg

    $\frac{\text{gr } 1}{60 \text{ mg}} = \frac{\text{gr } 10}{X \text{ mg}}$

    $X = 600$ mg

    (c) $\frac{60 \text{ mg}}{0.5 \text{ ml}} = \frac{600 \text{ mg}}{X \text{ ml}}$

    $60 X = 300$

    $X = 5$ ml (paras 2-2, 2-3, 2-7, 2-17)

11. $\frac{1 \text{ tablet}}{20 \text{ mg}} = \frac{X \text{ tablets}}{30 \text{ mg}}$

    $20 X = 30$

    $X = 1.5$ or 1 1/2 tablets (paras 2-2, 2-3, 2-14, 2-16)

12. $\frac{1 \text{ tablet}}{250 \text{ mg}} = \frac{X \text{ tablets}}{125 \text{ mg}}$

    $250 X = 125$

    $X = 1/2$ tablet per dose

    1/2 X 3 = 1 1/2 tablets per day (paras 2-2, 2-3, 2-14, 2-16)

13. $\frac{125\text{ mg}}{5\text{ ml}} = \frac{250\text{ mg}}{X\text{ ml}}$

125 X = 1250

X = 10 ml (paras 2-2, 2-3, 2-17)

14. $\frac{30\text{ mg}}{5\text{ ml}} = \frac{100\text{ mg}}{X\text{ ml}}$

30 X = 500

X = 16.7 ml (paras 2-2, 2-3, 2-10, 2-14, 2-17)

15. $\frac{125\text{ mg}}{5\text{ ml}} = \frac{500\text{ mg}}{X\text{ ml}}$

125 X = 2500

X = 20 ml per day (paras 2-2, 2-3, 2-17)

16. $\frac{40\text{ mg}}{1\text{ ml}} = \frac{65\text{ mg}}{X\text{ ml}}$

40 X = 65

X = 1.6 ml (paras 2-2, 2-3, 2-18a)

17. $\frac{1\text{ mg}}{1\text{ ml}} = \frac{0.3\text{ mg}}{X\text{ ml}}$

X = 0.3 ml (paras 2-2, 2-3, 2-18a)

18. (a) $\frac{10\text{ mg}}{1\text{ ml}} = \frac{\text{gr } 1/4}{X\text{ ml}}$

(b) $\frac{60\text{ mg}}{\text{gr } 1} = \frac{X\text{ mg}}{\text{gr } 1/4}$

X = 15 mg

(c) $\frac{10\text{ mg}}{1\text{ ml}} = \frac{15\text{ mg}}{X\text{ ml}}$

10 X = 15

X = 1.5 ml (paras 2-2, 2-3, 2-10, 2-18a)

19. $\frac{0.5 \text{ mg}}{2 \text{ ml}} = \frac{0.125 \text{ mg}}{X \text{ ml}}$

0.5 X = 0.250

X = 0.5 ml (paras 2-2, 2-3, 2-18a)

20. $\frac{\text{gr } 1/150}{0.8 \text{ ml}} = \frac{\text{gr } 1/200}{X \text{ ml}}$

$\frac{1}{150} X = .004 \text{ ml}$

X = 0.6 ml (paras 2-2, 2-3, 2-15a)

21. (a) $\frac{1 \text{ gm}}{2 \text{ ml}} = \frac{500 \text{ mg}}{X \text{ ml}}$

(b) 1 gm = 1000 mg

(c) $\frac{1000 \text{ mg}}{2 \text{ ml}} = \frac{500 \text{ mg}}{X \text{ ml}}$

1000 X = 1000

X = 1 ml (paras 2-2, 2-3, 2-10, 2-18a)

22. $\frac{2.2 \text{ ml}}{500 \text{ mg}} = \frac{X \text{ ml}}{250 \text{ mg}}$

500 X = 550

X = 1.1 ml (paras 2-2, 2-3, 2-18b)

23. $\frac{100 \text{ units}}{1 \text{ ml}} = \frac{46 \text{ units}}{X \text{ ml}}$

100 X = 46

X = 0.46 ml (paras 2-2, 2-3, 2-18d)

24. $\frac{40 \text{ units}}{1 \text{ ml}} = \frac{20 \text{ units}}{X \text{ ml}}$

40 X = 20

X = 0.5 ml (paras 2-2, 2-3, 2-18d)

25. $\frac{10{,}000 \text{ units}}{1 \text{ ml}} = \frac{2000 \text{ units}}{X \text{ ml}}$

10,000 X = 2000

X = 0.2 ml (paras 2-2, 2-3, 2-18c)

26. $\frac{250 \text{ mg}}{1.5 \text{ ml}} = \frac{350 \text{ mg}}{X \text{ ml}}$

250 X = 525

X = 2.1 ml (paras 2-2, 2-3, 2-18b)

27. (a) $\frac{333 \text{ mg}}{1 \text{ ml}} = \frac{0.25 \text{ gm}}{X \text{ ml}}$

(b) $\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.25 \text{ gm}}{X \text{ mg}}$

X = 250 mg

(c) $\frac{333 \text{ mg}}{1 \text{ ml}} = \frac{250 \text{ mg}}{X \text{ ml}}$

333 X = 250

X = 0.8 ml (paras 2-2, 2-3, 2-10, 2-18b)

28. (a) $\frac{1 \text{ gm}}{2.5 \text{ ml}} = \frac{750 \text{ mg}}{X \text{ ml}}$

(b) $\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{X \text{ gm}}{750 \text{ mg}}$

1000 X = 750

X = .75 gm

(c) $\frac{1\text{ gm}}{2.5\text{ ml}} = \frac{.75\text{ gm}}{X\text{ ml}}$

X = 1.875 = 1.9 ml (paras 2-2, 2-3, 2-10, 2-18b)

29. $\frac{1{,}000{,}000\text{ units}}{1\text{ ml}} = \frac{1{,}500{,}000\text{ units}}{X\text{ ml}}$

1,000,000 X = 1,500,000

X = 1.5 ml (paras 2-2, 2-3, 2-18b)

30. (a) $\frac{250{,}000\text{ units}}{1\text{ kg}} = \frac{X\text{ units}}{30\text{ kg}}$

X = 7,500,000 units per day

(b) $\frac{1{,}000{,}000\text{ units}}{10\text{ ml}} = \frac{7{,}500{,}000\text{ units}}{X\text{ ml}}$

1,000,000 X = 75,000,000

X = 75 ml per day

75. 6 = 12.5 ml per dose (paras 2-2, 2-3, 2-18e)

31. $\frac{10{,}000\text{ units}}{1\text{ ml}} = \frac{2000\text{ units}}{X\text{ ml}}$

10,000 X = 2,000

X = 0.2 ml (paras 2-2, 2-3, 2-18c)

32. $\frac{200{,}000\text{ units}}{1\text{ ml}} = \frac{300{,}000\text{ units}}{X\text{ ml}}$

200,000 X = 300,000

X = 1.5 ml (paras 2-2, 2-3, 2-18a)

33. $\frac{\frac{1}{gr\ 150}}{2\ ml} = \frac{\frac{1}{gr\ 200}}{X\ ml}$

$\frac{1\ X}{150} = \frac{1}{100}$

X = 1.5 ml (paras 2-2, 2-3, 2-18a)

34. (a) $\frac{\frac{1}{6\ gr}}{1\ ml} = \frac{6\ mg}{X\ ml}$

(b) $\frac{\frac{1}{1\ gr}}{60\ mg} = \frac{6\ gr}{X\ mg}$

X = 10 mg

(c) $\frac{10\ mg}{1\ ml} = \frac{6\ mg}{X\ ml}$

10 X = 6

X = 0.6 ml (paras 2-2, 2-3, 2-10, 2-18a)

35. (a) $\frac{30\ mg}{2\ ml} = \frac{gr\ 1/4}{X\ ml}$

(b) $\frac{gr\ 1}{60\ mg} = \frac{gr\ 1/4}{X\ ml}$

X = 15 mg

(c) $\frac{30\ mg}{2\ ml} = \frac{15\ mg}{X\ ml}$

30 X = 30

X = 1 ml (paras 2-2, 2-3, 2-10, 2-18a)

36. (a) $\frac{150\text{ mg}}{1\text{ ml}} = \frac{0.6\text{ gm}}{X\text{ ml}}$

(b) $\frac{1\text{ gm}}{1000\text{ mg}} = \frac{0.6\text{ gm}}{X\text{ mg}}$

$X = 600$ mg

(c) $\frac{150\text{ mg}}{1\text{ ml}} = \frac{600\text{ mg}}{X\text{ ml}}$

$150X = 600$

$X = 4$ ml (paras 2-2, 2-3, 2-10, 2-18a)

37. $\frac{1\text{ oz}}{30\text{ ml}} = \frac{X\text{ oz}}{45\text{ ml}}$

$30X = 45$

$X = 1.5$ oz (paras 2-2, 2-3, 2-11, 2-17)

38. (a) $\frac{1\text{ tablet}}{125\text{ mg}} = \frac{X\text{ tablets}}{0.5\text{ gm}}$

(b) $\frac{1\text{ gm}}{1000\text{ mg}} = \frac{0.5\text{ gm}}{X\text{ mg}}$

$X = 500$ mg

(c) $\frac{1\text{ tablet}}{125\text{ mg}} = \frac{X\text{ tablets}}{500\text{ mg}}$

$125X = 500$

$X = 4$ tablets (paras 2-2, 2-3, 2-10, 2-16)

39. (a) $\frac{1\text{ tablet}}{0.05\text{ mg}} = \frac{X\text{ tablets}}{25\text{ mcg}}$

(b) $\frac{1\text{ mg}}{1000\text{ mcg}} = \frac{X\text{ mg}}{25\text{ mcg}}$

$1000X = 25$

$X = 0.025$ mg

(c) $\frac{1 \text{ tablet}}{0.05 \text{ mg}} = \frac{X \text{ tablets}}{0.025 \text{ mg}}$

$0.05 X = 0.025$

$X = 0.5$ or 1/2 tablet (paras 2-2, 2-3, 2-10, 2-16)

40. $\frac{80 \text{ mg}}{15 \text{ ml}} = \frac{60 \text{ mg}}{X \text{ ml}}$

$80 X = 900$

$X = 11.3$ ml (paras 2-2, 2-3, 2-17)

## Section IV. COMPUTING INTRAVENOUS INFUSION RATES

### 2-22. INFORMATION REQUIRED ON AN ORDER FOR I.V. FLUIDS

a. Type of fluid to be infused.

b. Volume of the fluid to be infused.

c. Time period over which the fluid is to be infused.

### 2-23. I.V. ADMINISTRATION SET CALIBRATIONS

a. I.V. flow rates are regulated in drops per minute (gtts/min).

b. The size of the drop (drop factor) varies from large to small, and depending on the manufacturer and type of set used, it will require 10, 15, or 20 gtts to equal 1 ml in standard macrodrip sets, and 60 gtts to equal 1 ml in micro- or minidrip sets. (See examples in figure 2-6.)

### 2-24. OBJECTIVES OF I.V. THERAPY

a. To supply fluids when patients are unable to take adequate fluids by mouth.

b. To provide salts needed to maintain electrolyte balance: KCL, calcium, magnesium.

c. To provide glucose for metabolism.

(1) $D_5W$ = 5% Dextrose.

(2) $D_{10}W$ = 10% Dextrose.

(3) $D_{5\ 1/2}NS$ = 5% Dextrose, .45% Normal Saline.

(4) $D_5NS$ = 5% Dextrose, .9% Normal Saline.

(5) $D_{5\ 1/4}NS$ = 5% dextrose, .23% Normal Saline.

d. To provide water-soluble vitamins.

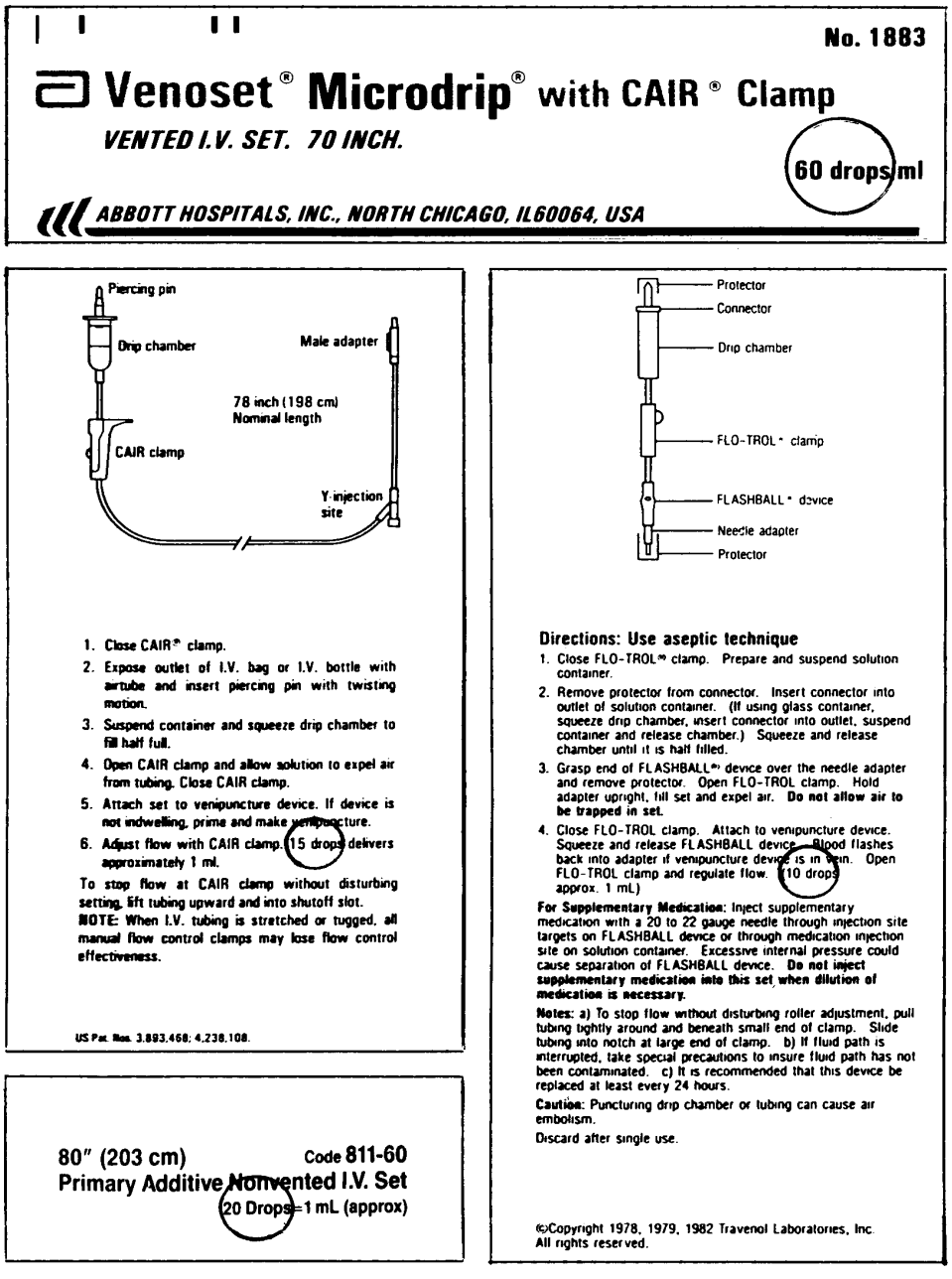



Figure 2-6. I.V. set calibrations.

## 2-25. FACTORS THAT INFLUENCE VOLUME DETERMINATION

a. Patient's daily maintenance requirements.

b. Volume losses prior to therapy.

c. Concurrent losses; gastric suction, vomiting, or diarrhea.

d. Patient's metabolic requirements.

## 2-26. COMPUTING CONTINUOUS I.V. INFUSION RATES

a. **I.V. Formula.**

**EXAMPLE #1**: The order is for $D_{5\ 1/2}NS$ 1000 ml to be infused over eight hours. Calculate the infusion rate using an I.V. set calibrated to deliver 20 gtts/ml.

$$\frac{\text{Volume (ml) x drop factor (gtts/ml)}}{\text{Time (minutes)}}$$

$$\frac{1000 \text{ ml} \times 20 \text{ gtts/ml}}{480}$$

$$\frac{20{,}000}{480} = 41.67 = 42 \text{ gtts/min.}$$

**NOTE**: For I.V.'s, round off to the nearest whole number.

**EXAMPLE #2**: The patient is to receive 1000 ml of 0.45% sodium chloride over the next 10 hours. The drop factor of the tubing is 15 gtts/ml. Determine the rate in gtts/min.

$$\frac{1000 \text{ ml} \times 15 \text{ gtts/ml}}{600 \text{ minutes}}$$

$$\frac{15{,}000}{600} = 25 \text{ gtts/min.}$$

**EXAMPLE #3**: The order is to infuse $D_{5\ 1/2}NS$ at 125 ml/hr for the next 24 hours. The I.V. administration set is calibrated 20 gtts/ml. Calculate the infusion rate.

$$\frac{\text{Volume x drop factor}}{\text{Time (min.)}}$$

$$\frac{125 \text{ ml/hr} \times 20 \text{ gtts/ml}}{60 \text{ min.}}$$

$$\frac{2500}{60} = 42 \text{ gtts/min.}$$

**PRACTICE 1**: The order is to infuse 1500 ml of Ringer's lactate over the next 24 hours. The drop factor of the tubing is 60 gtts/ml. Determine the rate in gtts/min.

**SOLUTION**:

$$\frac{1500 \text{ ml} \times 60 \text{ gtts/ml}}{1440}$$

$$\frac{90{,}000}{1440} = 63 \text{ gtts/min}$$

**PRACTICE 2**: The order is to give 250 ml of Rheomacrodex (dextran 40) over 45 minutes. The drop factor of the tubing is 10 gtts/ml. Determine the rate in gtts/min.

**SOLUTION**:

$$\frac{250 \text{ ml} \times 10 \text{ gtts/ml}}{45}$$

$$\frac{2500}{45} = 56 \text{ gtts/min}$$

b. **Practice Problems.**

(1) The patient is to receive 2000 ml of $D_5NS$ over 12 hours. The drop factor of the tubing is 15 gtts/ml. Determine the infusion rate.

**SOLUTION**:

$$\frac{2000 \text{ ml} \times 15 \text{ gtts/ml}}{720}$$

$$\frac{30{,}000}{720} = 42 \text{ gtts/ml}$$

(2) The physician has ordered 2000 ml of NS at a rate of 125 ml/hr for the next 16 hours. The drop factor of the tubing is 20 gtts/ml. Determine the rate in gtts/min.

**SOLUTION**:

$$\frac{125 \text{ ml} \times 20 \text{ gtts/ml}}{60}$$

$$\frac{2500}{60} = 42 \text{ gtts/min}$$

(3) The order is to infuse 1500 ml of Ringer's lactate over the next 24 hours. The drop factor of the tubing is 20 gtts/ml. Determine the rate in gtts/min.

**SOLUTION**:

$$\frac{1500 \text{ ml} \times 20 \text{ gtts/ml}}{1440}$$

$$\frac{30{,}000}{1440} = 21 \text{ gtts/min.}$$

(4) The patient is to receive Intralipid 10% at a rate of 500 ml over 4 hours. The drop factor of the tubing is 10 gtts/ml. Determine the infusion rate.

**SOLUTION**:

$$\frac{500 \text{ ml} \times 10 \text{ gtts/ml}}{240}$$

$$\frac{5000}{240} = 21 \text{ gtts/min.}$$

(5) The order is to infuse 1000 ml of $D_5W$ over 24 hours to keep the vein open. Using I.V. with a drop factor of 60 gtts/ml, determine the infusion rate.

**SOLUTION**:

$$\frac{1000 \text{ ml} \times 60 \text{ gtts/ml}}{1440}$$

$$\frac{60{,}000}{1440} = 42 \text{ gtts/min.}$$

## 2-27. ADMINISTRATION OF MEDICATIONS BY IVPB (INTERMITTENT INFUSION)

**NOTE:** Intermittent infusion of medications requires giving a drug through an in-progress I.V. or through a special I.V. catheter called a heparin lock.

a. The terms piggyback and I.V. piggyback (IVPB) are commonly used when referring to any intermittent infusion that requires more than 5 minutes to complete.

b. The medication is usually diluted in 50 to 100 ml of I.V. fluid and infused over about 30 minutes.

**EXAMPLE**: The order is to give Cimetidine 300 mg IVPB q 6h. It is recommended that this medication be dissolved in 100 ml of I.V. solution ($D_5W$) and infused over 30 minutes. Using a drop factor of 20 gtts/ml, determine the infusion rate.

$$\frac{100 \text{ ml} \times 20 \text{ gtts/ml}}{30}$$

$$\frac{2000}{30} = 67 \text{ gtts/min.}$$

**PRACTICE #1**: The order is to give 6,000,000 units of Penicillin G IVPB q 4h. The medication is to be dissolved in 150 ml of I.V. fluid, and the recommended infusion time is 1 1/2 hours. Using a drop factor of 20 gtts/ml, determine the infusion rate.

**SOLUTION**:

$$\frac{150 \text{ ml} \times 20 \text{ gtts/ml}}{90}$$

$$\frac{3000}{90} = 33 \text{ gtts/min.}$$

**PRACTICE #2**: The order is to give Solu-Medrol 125 mg IVPB q.4h. The medication is to be dissolved in 50 ml of I.V. fluid and the recommended administration time is 15 minutes. Using a drop factor of 20 gtts/ml, determine the infusion rate.

**SOLUTION**:

$$\frac{50 \text{ ml} \times 20 \text{ gtts/ml}}{15}$$

$$\frac{1000}{15} = 67 \text{ gtts/min.}$$

## 2-28. ADMINISTRATION OF MEDICATIONS BY CONTINUOUS INFUSION

**NOTE**: With continuous I.V. infusions of medications, the physician will order a medication dosage and not fluid volume. For example, the order may specify mg/hr or units/hr.

**EXAMPLE**: The order is to administer a continuous I.V. Heparin drip at a rate of 1200 units per hour. The pharmacy sends up a 250 ml bag of Normal Saline with 25,000 units of Heparin added. Using a drop factor of 60 gtts/ml, determine the infusion rate to deliver the ordered amount of medication.

a. Determine the amount of drug in the solution.

$$\frac{25{,}000 \text{ units}}{250 \text{ ml}}$$

b. Determine the number of ml/hr to be administered to give the ordered dosage.

$$\frac{25{,}000 \text{ units}}{250 \text{ ml}} = \frac{1200 \text{ units}}{X \text{ ml}}$$

$$25{,}000\,X = 300{,}000$$

$$X = 12 \text{ ml/hr}$$

c. Determine the infusion rate in gtts/min.

$$\frac{12 \text{ ml} \times 60 \text{ gtts/ml}}{60}$$

$$\frac{720}{60} = 12 \text{ gtts/min}$$

**PRACTICE #1**: The physician has ordered a continuous infusion of Aminophylline at a rate of 25 mg/hr. The pharmacy sends up a 500 ml bag of $D_5W$ with 500 mg of Aminophylline added. Using a drop factor of 60 gtts/ml, determine the infusion rate.

**SOLUTION**:

a. $\frac{500 \text{ mg}}{500 \text{ ml}}$

b. $\frac{500 \text{ mg}}{500 \text{ ml}} = \frac{25 \text{ mg}}{X \text{ ml}}$

$500 X = 12{,}500$

$X = 25$ ml/hr

c. $\frac{25 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{1500}{60} = 25$ gtts/min

**PRACTICE #2**: The patient is to receive a regular insulin drip of 10 units/hr. The pharmacy sends up a 250 ml bag of normal saline with 100 units of regular insulin added. The I.V. administration set delivers 60 gtts/ml. How many gtts/min will you administer?

**SOLUTION**:

a. $\frac{100 \text{ units}}{250 \text{ ml}}$

b. $\frac{100 \text{ units}}{250 \text{ ml}} = \frac{10 \text{ units}}{X \text{ ml}}$

$100 X = 2500$

$X = 25$ ml/hr

c. $\frac{25 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{1500}{60} = 25$ gtts/min

## 2-29. PRACTICE 2-4 (COMPUTING INTRAVENOUS INFUSION RATES)

a. The order is to infuse an I.V. of $D_5W$ 1000 ml over 12 hours. Calculate the infusion rate using an I.V. set that delivers 20 gtts/ml.

b. The order is to infuse a 0.9% normal saline 250 ml over 45 minutes. Calculate the infusion rate using an I.V. set that delivers 10 gtts/ml.

c. The order is to infuse $D_5RL$ 1000 ml q 8h for 24 hours. Calculate the infusion rate using a drop factor of 15 gtts/ml.

d. The order is for 2000 ml of hyperalimentation to infuse over 24 hours. The I.V. set delivers 60 gtts/ml. The solution should be administered at a rate of _____ gtts/min.

e. The patient is to receive 1200 ml of $D_5RL$ over 10 hours. The I.V. set delivers 20 gtts/ml. The infusion rate will be _____ gtts/min.

f. Administer 150 ml of Normal Saline over 30 minutes using an I.V. set that delivers 10 gtts/ml. The infusion rate will be _____.

g. The order is for Amikacin Sulfate 100 mg to be dissolved in 150 ml of $D_5W$ to run over 1 hour. Using an I.V. set that delivers 20 gtts/ml, determine the infusion rate.

h. The order is for Gentamycin 180 mg IVPB q 8h. The medication is dissolved in 100 ml of $D_5W$ and should infuse over 45 minutes. Using a drop factor of 20 gtts/ml, determine the infusion rate.

i. The order is to infuse 500 ml of 0.9% NS over 2 hours. The I.V. administration set delivers 15 gtts/ml. How many gtts/min will you administer?

j. You are to infuse $D_5W$ at 15 ml/hr to a pediatric patient. The I.V. administration set delivers 60 gtts/ml. Determine the infusion rate.

k. The order is to give two units of whole blood (1 unit is 500 ml). The blood is to infuse over the next 4 hours and the drop factor of the tubing is 10 gtts/ml. Determine the infusion rate in gtts/min.

l. The patient is to receive 3 units of packed red blood cells (1 unit equals 250 ml) to be infused over the next 4 hours. The drop factor is 10 gtts/ml. Determine the infusion rate in gtts/min.

m. The order is to infuse 1000 ml $D_5NS$ with 40 mEq KCl* over the next 8 hours. Using I.V. tubing with a drop factor of 20 gtts/ml, determine the infusion rate.

* KCl (potassium chloride) is always measured in milliequivalents (mEq).

n. The physician orders an I.V. of 1000 ml of $D_{5\ 1/4}NS$ to have 20 mEq of KCl added. The KCl is available in multiple dose vials with 2 mEq per ml. How many ml of KCl should be added to the I.V. solution?

o. An I.V. of $D_5W$ with 20 mEq KCl is ordered to run at 20 ml/hr using a microdrop set calibrated at 60 gtts/ml. Determine the infusion rate.

p. The order is to infuse Intralipids 500 ml over 6 hours using a drop factor of 10 gtts/ml. Determine the infusion rate.

q. The order is for 0.45% NaC1 500 ml to infuse in 4 hours. The I.V. set drop factor is 20 gtts/min. Determine the infusion rate.

r. The order is to give Geopen 2 gm IVPB q 6h. The recommended dilution is 2 gm in 50 ml of I.V. solution to be administered over 15 minutes. Using a drop factor of 20 gtts/ml, determine the infusion rate.

s. The patient is to receive Aldomet 500 mg IVPB q 6h. The medication is dissolved in 100 ml of I.V. fluid. Each 500 mg is to be run in over 1 hour. Using a drop factor of 15 gtts/ml, determine the infusion rate.

t. The order is to give 100 mg of Aminophyllin in a total of 35 ml of fluid over the next 45 minutes. Using a drop factor of 60 gtts/ml, determine the rate in gtts/min.

u. The patient is to receive Heparin at a rate of 1500 units per hour. The I.V. has 30,000 units per 500 ml of $D_5W$. Using a drop factor of 60 gtts/ml, determine the infusion rate in gtts/min and ml/hr.

v. The patient is to receive Heparin 1400 units per hour. The pharmacy sends up a 250 ml bag of 0.9 normal saline with 25,000 units of heparin added. The I.V. set delivers 60 gtts/ml. Determine the infusion rate in gtts/min and ml/hr.

w. The order is for a continuous Regular Insulin drip of 15 units/hr. The pharmacy sends up a 250 ml bag of normal saline with 150 units of regular insulin. The I.V. administration set delivers 60 gtts/ml. Determine the infusion rate in gtts/min and ml/hr.

x. The order is for Aminophylline at 20 mg/hr. The pharmacy sends up a 500 ml bag of $D_5W$ with 500 mg of Aminophylline added. Using a drop factor of 60 gtts/ml, determine the infusion rate in gtts/min and ml/hr.

## 2-30. ANSWERS TO PRACTICE 2-4 (COMPUTING INTRAVENOUS INFUSION RATES)

a. $\frac{1000 \text{ ml} \times 20 \text{ gtts/ml}}{720}$

$\frac{20{,}000}{720} = 28 \text{ gtts/min}$

b. $\frac{250 \text{ ml} \times 10 \text{ gtts/ml}}{45}$

$\frac{2500}{45} = 56 \text{ gtts/min}$

c. $\frac{1000 \text{ ml} \times 15 \text{ gtts/ml}}{480}$

$\frac{15{,}000}{480} = 31 \text{ gtts/min}$

d. $\frac{2000 \text{ ml} \times 60 \text{ gtts/ml}}{1440}$

$\frac{120{,}000}{1440} = 83 \text{ gtts/min}$

e. $\frac{1200 \text{ ml} \times 20 \text{ gtts/ml}}{600}$

$\frac{24{,}000}{600} = 40 \text{ gtts/min}$

f. $\frac{150 \text{ ml} \times 10 \text{ gtts/ml}}{30}$

$\frac{1500}{30} = 50 \text{ gtts/min}$

g. $\frac{150 \text{ ml} \times 20 \text{ gtts/ml}}{60}$

$\frac{3000}{60} = 50$ gtts/min

h. $\frac{100 \text{ ml} \times 20 \text{ gtts/ml}}{45}$

$\frac{2000}{45} = 44$ gtts/min

i. $\frac{500 \text{ ml} \times 15 \text{ gtts/ml}}{120}$

$\frac{7500}{120} = 63$ gtts/min

j. $\frac{15 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{900}{60} = 15$ gtts/min

k. $\frac{1000 \text{ ml} \times 10 \text{ gtts/ml}}{240}$

$\frac{10,000}{240} = 42$ gtts/min

l. $\frac{750 \text{ ml} \times 10 \text{ gtts/ml}}{240}$

$\frac{7500}{240} = 31$ gtts/min

m. $\frac{1000 \text{ ml} \times 20 \text{ gtts/ml}}{480}$

$\frac{20,000}{480} = 42$ gtts/min

n. $\frac{2 \text{ mEq}}{1 \text{ ml}} = \frac{20 \text{ mEq}}{X \text{ ml}}$

$2X = 20$

$X = 10$ ml

o. $\frac{20 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{1200}{60} = 20$ gtts/min

p. $\frac{500 \text{ ml} \times 10 \text{ gtts/ml}}{360}$

$\frac{5000}{360} = 14$ gtts/min

q. $\frac{500 \text{ ml} \times 20 \text{ gtts/min}}{240}$

$\frac{10{,}000}{240} = 42$ gtts/min

r. $\frac{50 \text{ ml} \times 20 \text{ gtts/ml}}{15}$

$\frac{1000}{15} = 67$ gtts/min

s. $\frac{100 \text{ ml} \times 15 \text{ gtts/ml}}{60}$

$\frac{1500}{60} = 25$ gtts/min

t. $\frac{35 \text{ ml} \times 60 \text{ gtts/ml}}{45}$

$\frac{2100}{45} = 47$ gtts/min

u. (1) $\frac{30{,}000 \text{ units}}{500 \text{ ml}} = \frac{1500 \text{ units}}{X \text{ ml}}$

$30{,}000 X = 750{,}000$

$X = 25$ ml/hr

(2) $\frac{25 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{1500}{60} = 25$ gtts/min

v. (1) $\frac{25{,}000 \text{ units}}{250 \text{ ml}} = \frac{1400 \text{ units}}{X \text{ ml}}$

$25{,}000\ X = 350{,}000$

$X = 14$ ml/hr

(2) $\frac{14 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{840}{60} = 14$ gtts/min

w. (1) $\frac{150 \text{ units}}{250 \text{ ml}} = \frac{15 \text{ units}}{X \text{ ml}}$

$150\ X = 3750$

$X = 25$ ml/hr

(2) $\frac{25 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{1500}{60} = 25$ gtts/ml

x. (1) $\frac{500 \text{ mg}}{500 \text{ ml}} = \frac{20 \text{ mg}}{X \text{ ml}}$

$500\ X = 10{,}000$

$X = 20$ ml/hr

(2) $\frac{20 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

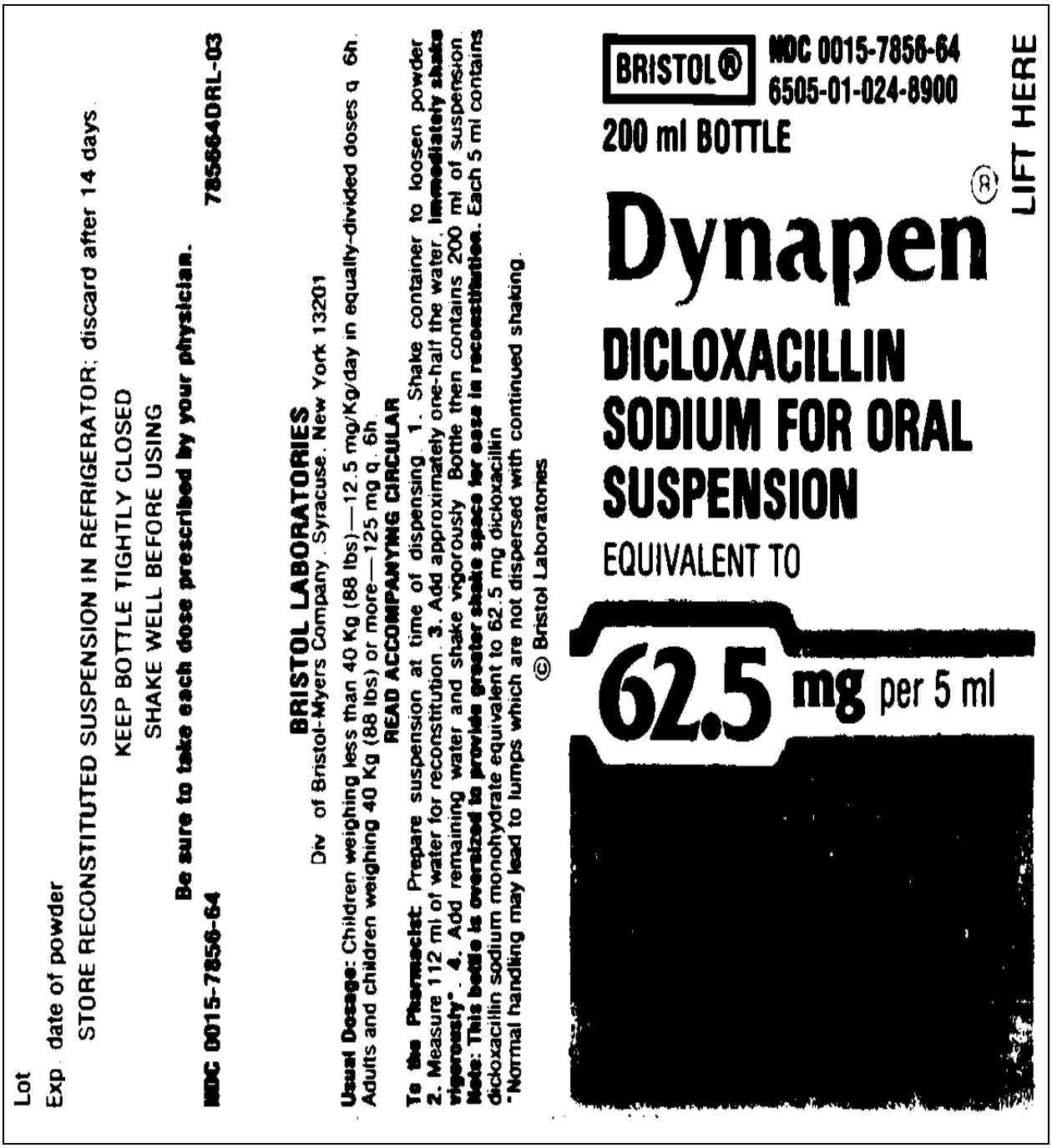
$\frac{1200}{60} = 20$ gtts/min

## Section V. BASIC DOSE CALCULATIONS

### 2-31. INTERPRETING INFORMATION FROM A MEDICATION LABEL

a. Generic name--the chemical name for a drug.

b. Trade name--a drug company's name for a particular drug.



c. Strength of the medication.

(1) Instructions for reconstitution.

(2) Concentration of the drug in a given volume of solution.

d. Special storage considerations--temperature.

e. Expiration date interpretation.

## 2-32. PRACTICE EXERCISE--LABEL INTERPRETATION (PART 1)

Directions: Read the labels provided to calculate the indicated doses (next page). All medications are in oral form, either tablet, pill, suspension, or capsules. Fill in the blanks; then check the solutions provided in paragraph 2-33.

a. Prepare a 20 mg dosage of Inderal _____ tab(s)

b. The order is for Ampicillin susp. 375 mg _____ ml

c. The order is for Benadryl 100 mg _____ cap(s)

d. Prepare 500 mg of penicillin V potassium _____ tab(s)

e. Prepare 500 mg of Amoxicillin susp _____ ml

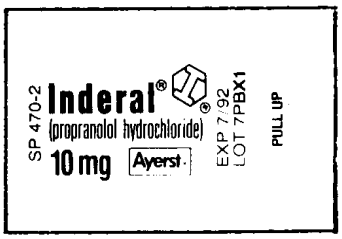
f. Isosorbide dinitrate 40 mg _____ cap(s)

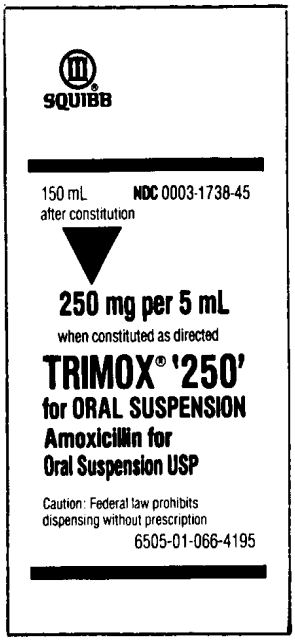
g. Prepare 150,000 u. of nystatin oral suspension . _____ ml

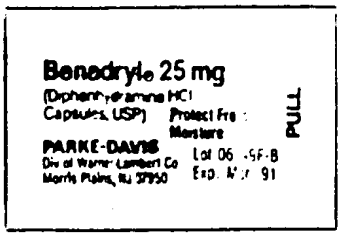
h. Acetaminophen 325 mg is ordered _____ tab(s)

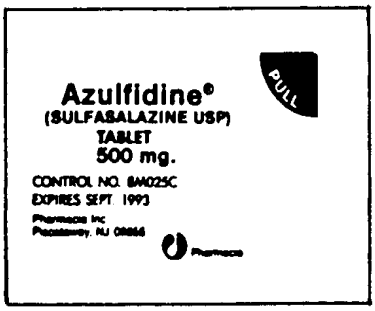
i. The order is for allopurinol 300 mg _____ tab(s)

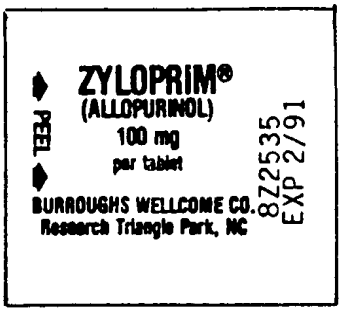
j. Prepare sulfasalazine 1000 mg _____ tab(s)

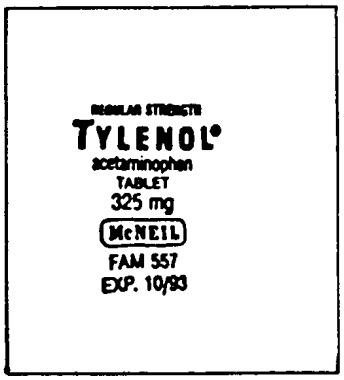

SP 470-2
Inderal®
(propranolol hydrochloride)
10 mg
Ayerst
EXP 7/92
LOT 7PBX1
PULL UP

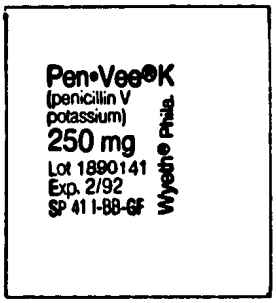

SQUIBB
150 mL
NDC 0003-1738-45
after constitution
250 mg per 5 mL
when constituted as directed
TRIMOX® '250'
for ORAL SUSPENSION
Amoxicillin for
Oral Suspension USP
Caution: Federal law prohibits
dispensing without prescription
6505-01-066-4195

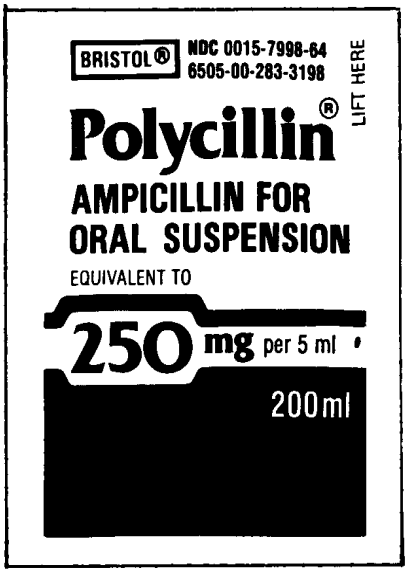

Benadryl® 25 mg
PARKE-DAVIS
PULL

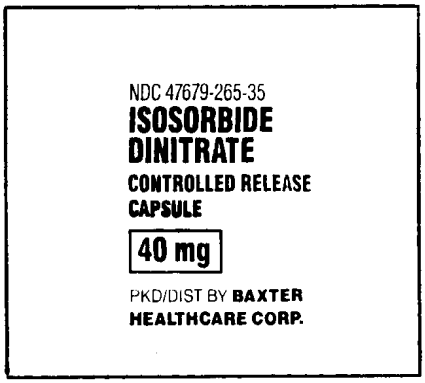

Azulfidine®
(SULFASALAZINE USP)
TABLET
500 mg.
CONTROL NO. 8M025C
EXPIRES SEPT 1993
PULL

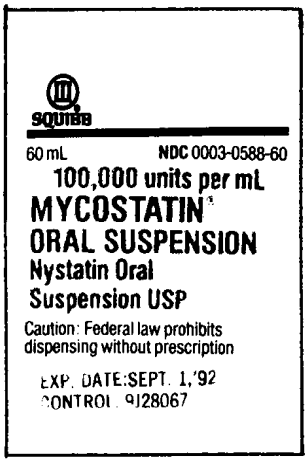

ZYLOPRIM®
(ALLOPURINOL)
100 mg
per tablet
PEEL
BURROUGHS WELLCOME CO.
Research Triangle Park, NC
827535
EXP 2/91


TYLENOL®
acetaminophen
TABLET
325 mg
McNEIL
FAM 557
EXP. 10/93


Pen•Vee®K
(penicillin V
potassium)
250 mg
Lot 1890141
Exp. 2/92
SP 411-88-GF
Wyeth® Phila.


BRISTOL®
NDC 0015-7998-64
6505-00-283-3198
LIFT HERE
Polycillin®
AMPICILLIN FOR
ORAL SUSPENSION
EQUIVALENT TO
250 mg per 5 ml
200 ml


NDC 47679-265-35
ISOSORBIDE
DINITRATE
CONTROLLED RELEASE
CAPSULE
40 mg
PKD/DIST BY BAXTER
HEALTHCARE CORP.


SQUIBB
60 mL
NDC 0003-0588-60
100,000 units per mL
MYCOSTATIN®
ORAL SUSPENSION
Nystatin Oral
Suspension USP
Caution: Federal law prohibits
dispensing without prescription
EXP. DATE:SEPT. 1,'92
CONTROL 9128067

## 2-33. ANSWERS TO PRACTICAL EXERCISE--LABEL INTERPRETATION (PART I)

a. $\frac{1 \text{ tab}}{10 \text{ mg}} = \frac{X \text{ tabs}}{20 \text{ mg}}$

$10 X = 20$

$X = 2$ tabs

b. $\frac{250 \text{ mg}}{5 \text{ ml}} = \frac{375 \text{ mg}}{X \text{ ml}}$

$250 X = 1875$

$X = 7.5$ ml

c. $\frac{1 \text{ cap}}{25 \text{ mg}} = \frac{X \text{ caps}}{100 \text{ mg}}$

$25 X = 100$

$X = 4$ caps

d. $\frac{1 \text{ tab}}{250 \text{ mg}} = \frac{X \text{ tabs}}{500 \text{ mg}}$

$250 X = 500$

$X = 2$ tabs

e. $\frac{250 \text{ mg}}{5 \text{ ml}} = \frac{500 \text{ mg}}{X \text{ ml}}$

$250 X = 2500$

$X = 10$ ml

f. 40 mg = 1 cap

g. $\frac{100{,}000 \text{ units}}{1 \text{ ml}} = \frac{150{,}000 \text{ units}}{X \text{ ml}}$

$100{,}000 X = 150{,}000$

$X = 1.5$ ml

h. 325 mg = 1 tab

i. $\frac{1 \text{ tab}}{100 \text{ mg}} = \frac{X \text{ tabs}}{300 \text{ mg}}$

100 X = 300

X = 3 tabs

j. $\frac{1 \text{ tab}}{500 \text{ mg}} = \frac{X \text{ tabs}}{1000 \text{ mg}}$

500 X = 1000

X = 2 tabs

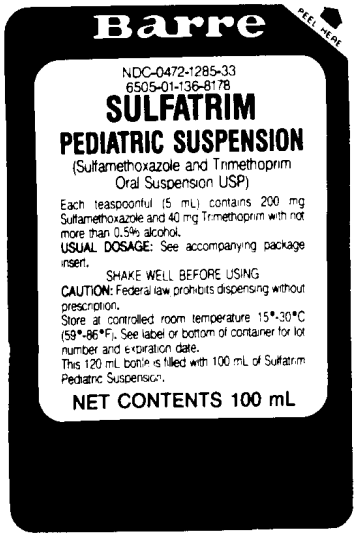
## 2-34. PRACTICAL EXERCISE--LABEL INTERPRETATION (PART II)

**DIRECTIONS**. Read the labels provided to prepare the indicated dosages. Round oral dosages to the nearest tenth, and parenteral dosages to the nearest hundredth. Fill in the blanks on items a through j; then check the solutions provided.

a. Aminophylline 200 mg P.O. q 6h _____ ml

b. Ampicillin 400 mg P.O. q 6h _____ ml

c. Sulfamethoxazole 350 mg (trimethoprim 70 mg) P.O. _____ ml


d. Digoxin elixir 0.08 mg P.O. _____ ml

e. Ceftriaxone 250 mg I.M. q 12h _____ ml

f. Dicloxicillin 150 mg P.O. q 8h _____ ml

g. Acetaminophen elixir 240 mg P.O. q 4h _____ ml

| Vial Strength | Concentration (units/ml) | Amount of Diluent |
|---|---|---|
| h. Penicillin G Potassium 20,000,000 units | 500,000 | _____ ml |

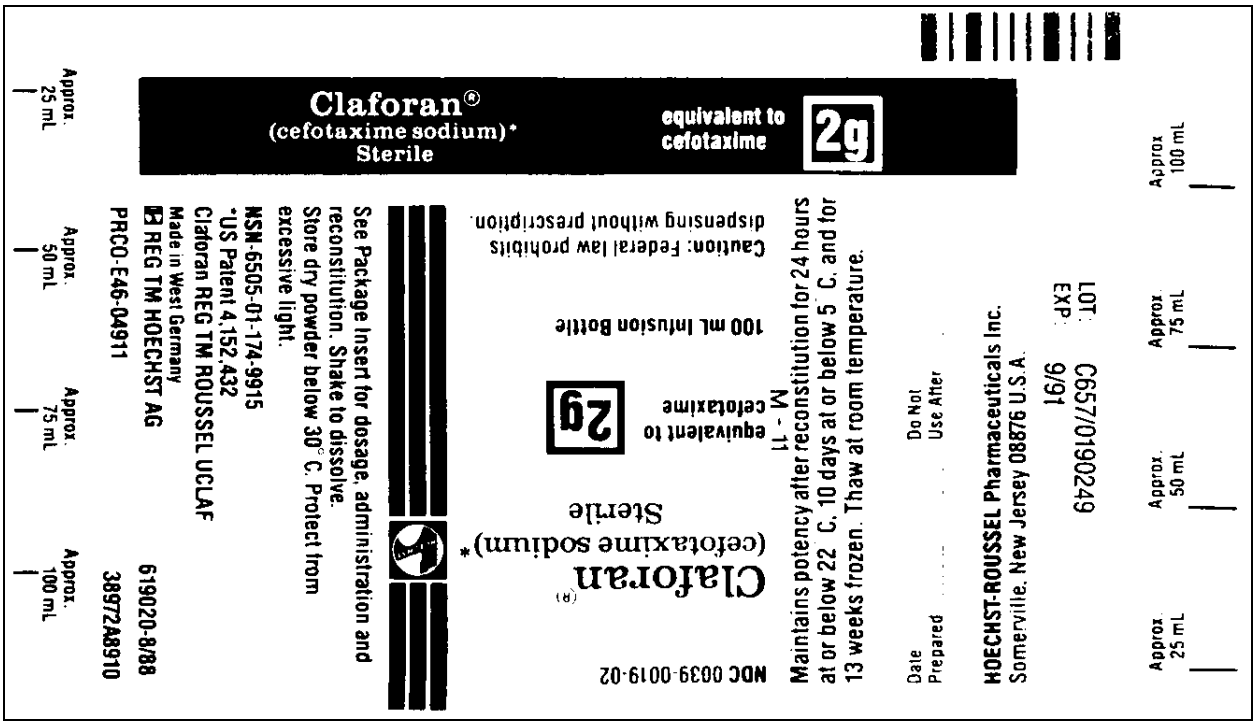
* Refer to the Penicillin G Potassium vial label and package insert to answer question h.


The following table shows the amount of solvent required for solution of various concentrations of 20,000,000 units:

| Desired Concentration (units/ml) | For Intravenous Infusion Only 20,000,000 units Approximate Volume (ml) of Solvent |
|---|---|
| 250,000 | 72.0 |
| 500,000 | 32.0 |
| 1,000,000 | 12.0 |

| | Vial Strength | Amount of Diluent | Dosage Strength of Prepared Solution |
|---|---|---|---|
| i. | cefotaxime 2 g (prepare for I.M. injection) | (1) _____ ml | (2) _____ mg/ml |

* Refer to the cefotaxime vial label and package insert to answer question i.




Preparation of Solution: Claforan for IM or IV administration should be reconstituted as follows:

| Strength | Amount of Diluent To Be Added (ml) | Approximate Withdrawable Volume (ml) | Approximate Average Concentration (mg/ml) |
|---|---|---|---|
| Intramuscular | | | |
| 1 g vial | 3 | 3.4 | 300 |
| 2 g vial | 5 | 6.0 | 330 |
| Intravenous | | | |
| 1 g vial | 10 | 10.4 | 95 |
| 2 g vial | 10 | 11.0 | 180 |

Shake to dissolve; inspect for particulate matter and discoloration prior to use. Solutions of Claforan range from very pale yellow to light amber, depending on concentration, diluent used, and length and condition of storage. For intramuscular use: Reconstitute VIALS with Sterile Water for Injection or Bacteriostatic Water for Injection as described above.

## 2-35. ANSWERS TO PRACTICAL EXERCISE--LABEL INTERPRETATION (PART II)

a. $\frac{105\ mg}{5\ ml} = \frac{200\ mg}{X\ ml}$

105 X = 1000

X = 9.5 ml

b. $\frac{250\ mg}{5\ ml} = \frac{400\ mg}{X\ ml}$

250 X = 2000

X = 8 ml

c. $\frac{200\ mg}{5\ ml} = \frac{350\ mg}{X\ ml}$ or $\frac{40\ mg}{5\ ml} = \frac{70\ mg}{X\ ml}$

200 X = 1750 or 40 X = 350

X = 8.8 ml X = 8.8 ml

d. $\frac{0.05\ mg}{1\ ml} = \frac{0.08\ mg}{X\ ml}$

0.05 X = 0.08

X = 1.6 ml

e. 250 mg/1 ml

f. $\frac{62.5\ mg}{5\ ml} = \frac{150\ mg}{X\ ml}$

62.5 X = 750

X = 12 ml

g. $\frac{80\text{ mg}}{1/2\text{ tsp}} = \frac{240\text{ mg}}{X\text{ ml}}$

$\frac{1\text{ tsp}}{5\text{ ml}} = \frac{1/2\text{ tsp}}{X\text{ ml}}$

X = 2.5 ml

$\frac{80\text{ mg}}{2.5\text{ ml}} = \frac{240\text{ mg}}{X\text{ ml}}$

80 X = 600

X = 7.5 ml

h. 32.0 ml

i. (1) 5 ml (2) 330 mg/ml

## 2-36. SUMMARY OF ROUNDING RULES FOR MEDICATION CALCULATIONS

a. Express IV DRIP RATES in WHOLE NUMBERS.

b. Express TABLETS in WHOLE OR HALVES.

c. INJECTABLES should be rounded to TENTHS, except for HEPARIN AND INSULIN, which are rounded to HUNDREDTHS.

d. P.O. LIQUIDS should be rounded to TENTHS.

e. Round KILOGRAMS to TENTHS.

**Continue with Exercises**

**EXERCISES, LESSON 2**

**INSTRUCTIONS:** Answer the following items by writing the answer in the space provided.

After you have completed all of these items, turn to "Solutions to Exercises" at the end of the lesson and check your answers with the solutions.

1. You wish to administer a dose of 15 mg of a particular drug to a patient. The drug is supplied in a multidose vial labeled 5 mg/ml. Calculate the volume (ml) of the drug to be administered.

2. A patient has been given five capsules. Each capsule contained 250 mg of a particular drug. Calculate the total number of mg of drug the patient received.

3. The mother of a pediatric patient tells you that she has given her child a total of 7 tsp of cough syrup over the past 24 hours. The amount of 7 tsp equals ____ ml.

4. The physician has ordered Chlorpromazine 20 mg I.M. for your patient. Chlorpromazine is labeled 25 mg/ml. Determine how many mls you will give.

5. The order is for Morphine gr 1/6 I.M. On hand is a Morphine tubex labeled 15 mg/ml. You will give ___ ml.

6. Convert the following weights to their equivalents:

   a. 1650 gm = ____ kg

   b. 19 lbs = _____ kg

   c. 14.5 lbs = ____ kg

   d. 70 lbs = _____ kg

   e. 200 mg = ____ gm

   f. 5 mg = ____ gr

   g. 10 mg = _____ gr

   h. 2 gm = _____ mg

   i. 40 gm = _____ mg

   j. 2.2 lbs = ____ kg

7. Your patient is to receive Lasix 40 mg P.O. q AM. Lasix is stocked in 20 mg tablets. How many tablets will you administer?

8. Your patient is to receive Digoxin 0.25 mg P.O. q AM. Digoxin is stocked in 0.125 mg tablets. How many tablets will you administer?

9. The physician has ordered Heparin 10,000 units SQ for your patient. Heparin is stocked in a multidose vial labeled 20,000 units/ml. How many ml's will you give?

10. The order is to give Atropine 0.6 mg. I.M. on call to surgery. On hand is a vial labeled Atropine 0.4 mg/ml. How many ml's will you give?

11. The order is to give Morphine 4 mg I.M. stat. Available is a vial labeled morphine 10 mg/ml. How many ml's will you give?

12. The order is to give Demerol 35 mg I.M. q 4h p.r.n. pain. The medication is supplied in a tubex labeled 50 mg/ml. How many ml's will you give?

13. The order is to give Valium 8 mg I.M. on call to surgery. The Valium stocked is labeled 10 mg/2 ml. How many ml's will you give?

14. The order is to give Prostaphlin 350 mg I.M. q 4h. Directions for reconstitution of the 1 gm vial state: Add 5.7 ml of sterile water. Each 1.5 ml will then contain 250 mg of medication. How many ml's will you give?

15. The order is to give Polycillin-N 700 mg I.M. q 4h. The directions for reconstitution of each 1-gm vial of Polycillin state: Add 3.4 ml of sodium chloride to produce a concentration of 250 mg/ml. How many ml's will you give?

16. The patient is to receive Vistaril 75 mg I.M. q 4h p.r.n. nausea. On hand is a vial containing 100 mg/2 ml. How many ml's will you give?

17. The order is to give Omnipen 350 mg I.M. q 6h. The directions on the vial state: Add 1.9 ml to produce a concentration of 125 mg/0.5 ml. How many ml will you give?

18. The patient is to receive 3 units of whole blood over the next 6 hours. Each unit contains 500 ml. Using a drop factor of 10 gtts/ml, determine the infusion rate.

19. The order is for 1000 ml $D_5W$ with 20 mEq KCl to alternate with 1000 ml $D_{5 1/2}NS$ with 20 mEq KCl over the next 24 hours at a rate of 150 ml/hr. Using a drop factor of 15 gtts/ml, determine the infusion rate.

20. The order is to give Cimetidine 300 mg IVPB q 6h. The medication is dissolved in 100 ml of $D_5W$ and is to infuse in 30 minutes. Using a drop factor of 20 gtts/ml, determine the infusion rate.

21. The order is to give Tobramycin 80 mg IVPB q 12h. The medication is added to 100 ml of $D_5W$ and is to infuse in 60 minutes. Using a drop factor of 15 gtts/ml, determine the infusion rate.

22. The order is to infuse 1500 ml of Ringer's lactate over the next 24 hours. The drop factor of the tubing is 60 gtts/ml. Determine the rate in gtts/min.

23. The patient is to receive 1000 ml of $D_{5 1/4}NS$ at 125 ml/hr. Using a drop factor of 20 gtts/ml, determine the infusion rate.

24. Your patient is to receive heparin 1500 units/hr by a continuous I.V. infusion. The pharmacy sends up a 500 ml bag of 0.9% sodium chloride with 25,000 units of heparin added. The I.V. set delivers 60 gtts/ml. The solution should be administered at a rate of ___gtts/min and ____ml/hr.

25. Case Study.

    Mr. K. was admitted with shortness of breath; rule out left lower lobe pneumonia. His current diagnosis is chronic obstructive pulmonary disease (COPD). Among his medical orders are the following: oxygen at 2 liters/min via nasal prongs; pulmonary toilet q 2h, out of bed as tolerated; Brethine 5 mg P.O. t.i.d.; Erythromycin 400 mg q 6h P.O.; Potassium Chloride solution 30 mEq P.O. b.i.d., dilute each tablespoon in 4 oz water or fruit juice.

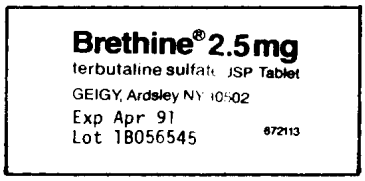
    Refer to the labels of the ordered medications to answer the questions that follow.

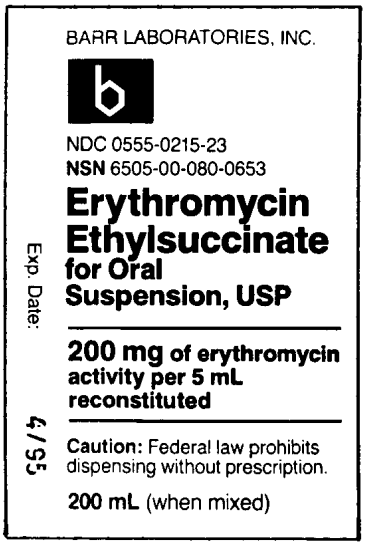
    a. How many mg's does each Brethine tablet contain?

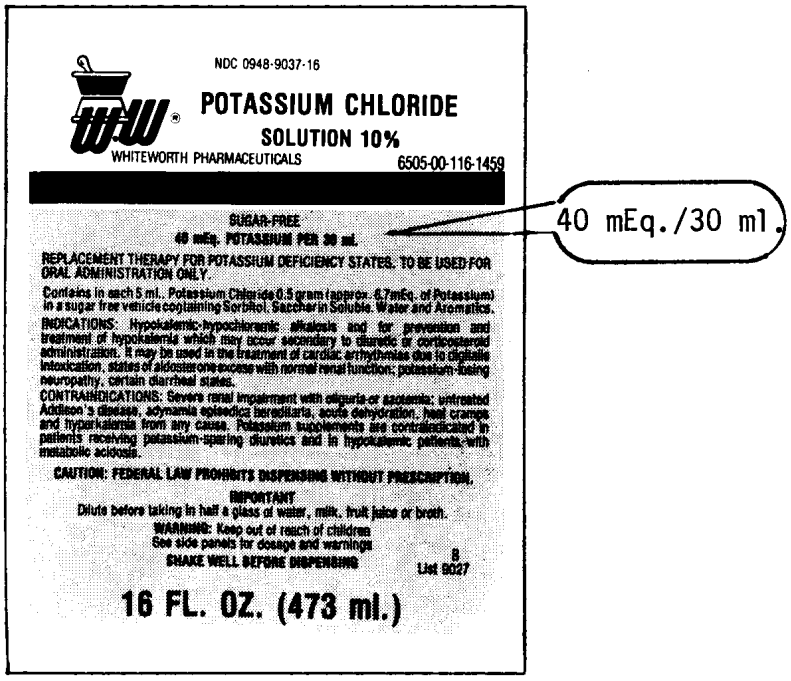
    b. How many Brethine tablets will you administer per dose? ____ per day?

    c. How many mg are in 1 ml of Erythromycin?

    d. How many ml's of Erythromycin will you administer per dose? ____ per day ?




e. How many days will one bottle of Erythromycin last?

f. How many ml's of Potassium Chloride should you give?

g. How many ounces of fruit juice should be used to dilute one dose of Potassium Chloride?

26. Case Study

G.W. is a 9-month-old child admitted with a chronic urinary tract infection. G.W. weighs 22 lbs. Currently, G.W. has a temperature of 104□R. Among her medical orders are foley catheterization to straight drainage; force fluids; urine for culture and sensitivity; Tylenol elixir q.i.d. p.r.n. for temp 101□ or greater; vital signs q 4h; I.V. of $D_5RL$ at 30°ml/hr; Sulfatrim suspension 10 mg q 6h; intake and output (weigh all diapers).

Refer to the dosage guidelines and medication labels to answer the questions which follow.

Dosage guidelines for Children's Tylenol Elixir:

| | |
|---|---|
| 4-11 months | one-half teaspoon |
| 12-23 months | three-quarters teaspoon |
| 2-3 years | one teaspoon |
| 4-5 years | one and one-half teaspoons |
| 6-8 years | two teaspoons |
| 9-10 years | two and one-half teaspoons |
| 11-12 years | three teaspoons |

Dosage guidelines for Sulfatrim

The recommended dosage of Sulfatrim for children with urinary tract infections is 8 mg/kg trimethoprim and 40 mg/kg sulfamethoxazole per 24 hours, given in two divided doses every 12 hours for 10 days. Use the following table as a guide for children two months of age or older.

| Weight | | Dose--every 12 hours |
|---|---|---|
| lb | kg | Teaspoonfuls |
| 22 | 10 | 1 ( 5 ml) |
| 44 | 20 | 2 (10 ml) |
| 66 | 30 | 3 (15 ml) |
| 88 | 40 | 4 (20 ml) |

a. Does the baby need a dose of Tylenol now? If so, how many cc's should you give?

b. How many mg of acetaminophen are in each dose of Tylenol?

c. Should you administer another dose of Tylenol later in the day?

d. It is 1400 hours and you have just checked vital signs. What time should you check again?

e. How many ml's of Sulfatrim should you administer?

f. How many mg of each of the two active ingredients are contained in each dose of Sulfatrim?

27. How many tablets of Tylenol would you administer if the physician ordered 600 mg for pain? On hand are 10 gr tablets.

28. The order is to give 1 oz of Maalox. How many tbsp's would you give?

29. The order is for 2.0 gm of Neomycin. On hand are 500 mg tablets. How many tablets will you give?

30. How many ounces of Maalox will you give if the order is for 45 ml?

31. The physician orders gr 1/32 of Dilaudid P.O. q 3-4h p.r.n. for pain. On hand are tablets gr 1/64 each. How many tablets will you give?

32. The order is for Erythromycin base 0.5 gm q 6h. On hand are 125 mg tablets. How many tablets will you give?

33. The order is to give 250 mcg of Lanoxin P.O. q AM using 0.125 mg tablets. How many tablets will you give?

34. The physician orders Fiorinal 30 mg P.O. On hand are gr 1/8 capsules. How many capsules will you give?

35. The order is to give Achromycin (tetracycline) syrup 0.25 gm P.O. q.i.d. The medication is available in syrup form, 125 mg per 5 ml. How many tsp's will you give?

36. The physician ordered Synthroid 25 mcg q AM. Available are 0.05 mg tablets. How many tablets will you give?


37. Case Study

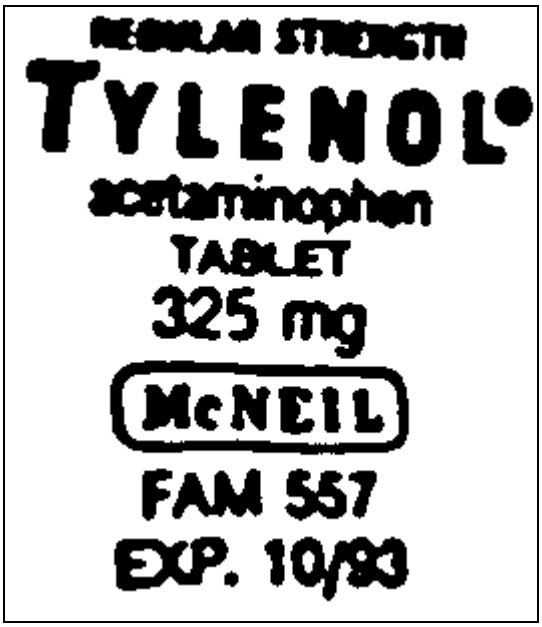
H.B., a 64-year-old male, was re-admitted with a post-operative wound infection. He was discharged three days earlier after having his appendix removed. He is seven days post-op. He has consistently had a temperature of 103º; wound is red with foul-smelling purilent drainage. Among his current medical orders are: Wet to dry dressing changes q 4h; vitals q 4h; antibiotic Prostaphlin IVPB 250 mg to be given q 6h; Tylenol 2 tabs q 4h prn for temp greater than 101º; up ad lib.

Refer to the reconstitution guidelines and label to answer the questions that follow.

Reconstitution guidelines for Prostaphlin IV

| Vial Size | Diluent | Resulting Concentration |
|---|---|---|
| 250 mg | 1.4 cc | 250 mg/1.5 cc |
| 500 mg | 2.7 cc | 250 mg/1.5 cc |
| 1 gm | 5.7 cc | 250 mg/1.5 cc |

Reconstitute with sterile water or sodium chloride injection.




a. What diluent(s) can be used to reconstitute the Prostaphlin?

b. How many ml of diluent should be added to the vial of Prostaphlin for reconstitution?

c. After reconstituting the vial of Prostaphlin, the 250 mg is further diluted in 100 ml of $D_5W$. Using minidrop (60 gtts/ml) tubing, how many gtts/min are needed to administer the Prostaphlin if the IV is to run for 1 1/2 hours?

d. How many mg of acetaminophen will each dose of Tylenol contain?

e. What is the maximum number of mg of Tylenol you can administer per day?

38. The physician ordered Cleocin 120 mg IVPB q 8h. The antibiotic is supplied in vials with 300 mg/2 ml. The guidelines for administration of Cleocin are to dilute the medication in 50 ml of $D_5W$ and infuse over 30 minutes.

a. How many ml's of Cleocin will you add to 50 ml of $D_5W$ for the ordered dose?

b. Using a drop factor of 60 gtts/ml, determine the infusion rate.

39. The order is to give 0.3 mg of Atropine I.M. on call to surgery. The medication is provided in a vial labeled gr 1/150 per ml. How many ml's should you give?

40. The order is to administer Regular Insulin at a rate of 7 u/hr via a continuous I.V. infusion. The pharmacy sends a 500-ml bag of 0.9% sodium chloride with 250 units of Regular insulin added. Using a drop factor of 60 gtts/ml, calculate the infusion rate in gtts/min and ml/hr.

41. The order is to give Mandol (Cefamandole) 1 gm q 6h IVPB. Recommended dilution is 100 ml of $D_5W$ or NS. Recommended rate of infusion is over 30 minutes. Using a drop factor of 20 gtts/ml, determine the infusion rate in gtts/min.

42. The order is to give Keflin 480 mg IVPB q 6h to a 19 kg child. The medication is supplied in a 500 mg vial. Reconstitution directions are: Add 5 ml of diluent to give a concentration of 500 mg/2.7 ml. You are to administer the Keflin in 25 ml of I.V. fluid over 30 minutes.

a. How many ml of medication will you add to the I.V. fluid?

b. Using a drop factor of 60 gtts/ml, determine the infusion rate.

43. The order is to administer 47 units of NPH insulin SQ q AM. You have a 10ºml vial of U100 NPH insulin. Using a tuberculin syringe, determine how many ml's to give.

44. The physician has ordered 700 units per hour of Heparin. The pharmacy sends 500 ml of $D_5NS$ with 20,000 u of Heparin. Using a drop rate factor of 60 gtts/ml, determine the infusion rate.

45. The physician has ordered 11,000 units of Heparin SQ q 12h. On hand is a vial labeled 40,000 units/ml. How many ml's will you give?

46. The order is for Decadron 5 mg I.M. Decadron is stocked in multiple dose vials labeled 4 mg/ml. How many ml's will you give?

47. The order is to give Atarax 30 mg I.M. Atarax is stocked in vials labeled 50 mg/ml. How much will you give?

48. The order is for Elixophyllin 100 mg P.O. q 6h. Elixophyllin is stocked 80 mg/15 ml. How many ml's will you administer?

49. The order is for Amoxicillin 375 mg P.O. q 8h. Amoxicillin is stocked as an oral suspension with 250 mg per 5 ml. How many ml's will you give?

50. The order is to infuse 1000 ml of $D_5$1/2NS at 125 ml/hr for the next 24 hours. Using a drop factor of 15 gtts/ml, determine the infusion rate.

**Check Your Answers on Next Page**

**SOLUTIONS TO EXERCISES, LESSON 2**

1. $\frac{5\text{ mg}}{1\text{ ml}} = \frac{15\text{ mg}}{X\text{ ml}}$

   $5X = 15$

   $X = 3$ ml (paras 2-5, 2-6, 2-17)

2. $\frac{1\text{ cap}}{250\text{ mg}} = \frac{5\text{ caps}}{X\text{ mg}}$

   $X = 1250$ mg (para s 2-5, 2-6, 2-16)

3. $\frac{1\text{ tsp}}{5\text{ ml}} = \frac{7\text{ tsp}}{X\text{ ml}}$

   $X = 35$ ml (para 2-5,2-6, 2-10)

4. $\frac{25\text{ mg}}{1\text{ ml}} = \frac{20\text{ mg}}{X\text{ ml}}$

   $25X = 20$

   $X = 0.8$ ml (para 2-5, 2-6, 2-18)

5. $\frac{15\text{ mg}}{1\text{ ml}} = \frac{\text{gr } 1/6}{X\text{ ml}}$

   $\frac{\text{gr } 1}{60\text{ mg}} = \frac{\text{gr } 1/6}{X\text{ mg}}$

   $X = 10$ mg

   $\frac{15\text{ mg}}{1\text{ ml}} = \frac{10\text{ mg}}{X\text{ ml}}$

   $15X = 10$

   $X = 0.7$ ml (paras 2-5, 2-6, 2-7, 2-10, 2-18)

6. a. $\frac{1000\ gm}{1\ kg} = \frac{1650\ gm}{X\ kg}$

$1000\ X = 1650$

$X = 1.65\ kg$ or $1.7\ kg$

b. $\frac{2.2\ lbs}{1\ kg} = \frac{19\ lbs}{X\ kg}$

$2.2\ X = 19$

$X = 8.6\ kg$

c. $\frac{2.2\ lbs}{1\ kg} = \frac{14.5\ lbs}{X\ kg}$

$2.2\ X = 14.5$

$X = 6.6\ kg$

d. $\frac{2.2\ lbs}{1\ kg} = \frac{70\ lbs}{X\ kg}$

$2.2\ X = 70$

$X = 31.8\ kg$

e. $\frac{1000\ mg}{1\ gm} = \frac{200\ mg}{X\ gm}$

$1000\ X = 200$

$X = 0.2\ gm$

f. $\frac{1\ gr}{60\ mg} = \frac{X\ gr}{5\ mg}$

$60\ X = 5$

$X = 1/12\ gr$

g. $\frac{1\text{ gr}}{60\text{ mg}} = \frac{X\text{ gr}}{10\text{ mg}}$

60 X = 10

X = 1/6 gr

h. $\frac{1\text{ gm}}{1000\text{ mg}} = \frac{2\text{ gm}}{X\text{ mg}}$

X = 2000 mg

i. $\frac{1\text{ gm}}{1000\text{ mg}} = \frac{40\text{ gm}}{X\text{ mg}}$

X = 40,000 mg

j. 2.2 lbs = 1 kg (para 2-10)

7. $\frac{1\text{ tablet}}{20\text{ mg}} = \frac{X\text{ tablets}}{40\text{ mg}}$

20 X = 40

X = 2 tablets (paras 2-5, 2-6, 2-16)

8. $\frac{1\text{ tablet}}{0.125\text{ mg}} = \frac{X\text{ tablets}}{0.25\text{ mg}}$

0.125 X = 0.25

X = 2 tablets (paras 2-5, 2-6, 2-16)

9. $\frac{20{,}000\text{ units}}{1\text{ ml}} = \frac{10{,}000\text{ units}}{X\text{ ml}}$

20,000 X = 10,000

X = 0.5 ml (paras 2-5, 2-6, 2-18)

10. $\frac{0.4\text{ mg}}{1\text{ ml}} = \frac{0.6\text{ mg}}{X\text{ ml}}$

0.4 X = 0.6

X = 1.5 ml (paras 2-5, 2-6, 2-18)

11. $\frac{10\text{ mg}}{1\text{ ml}} = \frac{4\text{ mg}}{X\text{ ml}}$

10 X = 4

X = 0.4 ml (paras 2-5, 2-6, 2-18)

12. $\frac{50\text{ mg}}{1\text{ ml}} = \frac{35\text{ mg}}{X\text{ ml}}$

50 X = 35

X = 0.7 ml (paras 2-5, 2-6, 2-18)

13. $\frac{10\text{ mg}}{2\text{ ml}} = \frac{8\text{ mg}}{X\text{ ml}}$

10 X = 16

X = 1.6 ml (paras 2-5, 2-6, 2-18)

14. $\frac{1.5\text{ ml}}{250\text{ mg}} = \frac{X\text{ ml}}{350\text{ mg}}$

250 X = 525

X = 2.1 ml

(paras 2-5, 2-6, 2-18)

15. $\frac{250\text{ mg}}{1\text{ mg}} = \frac{700\text{ mg}}{X\text{ ml}}$

250 X = 700

X = 2.8 ml (paras 2-5, 2-6, 2-18)

16. $\frac{100\text{ mg}}{2\text{ ml}} = \frac{75\text{ mg}}{X\text{ ml}}$

100 X = 150

X = 1.5 ml (paras 2-5, 2-6, 2-18)

17. $\frac{125\text{ mg}}{0.5\text{ ml}} = \frac{350\text{ mg}}{X\text{ ml}}$

125 X = 175

X = 1.4 ml (paras 2-5, 2-6, 2-18)

18. $\frac{1\text{ unit}}{500\text{ ml}} = \frac{3\text{ units}}{X\text{ ml}}$

X = 1500 ml

$\frac{1500\text{ ml} \times 10\text{ gtts/ml}}{360}$

$\frac{15{,}000}{360} = 41.7 = 42\text{ gtts/min}$ (paras 2-5, 2-6, 2-7, 2-28)

19. $\frac{150\text{ ml} \times 15\text{ gtts/ml}}{60}$

$\frac{2250}{60} = 37.5 = 38\text{ gtts/min}$ (paras 2-7, 2-26)

20. $\frac{100\text{ ml} \times 20\text{ gtts/ml}}{30}$

$\frac{2000}{30} = 66.7 = 67\text{ gtts/min}$ (paras 2-7, 2-27)

21. $\frac{100\text{ ml} \times 15\text{ gtts/min}}{60}$

$\frac{1500}{60} = 25\text{ gtts/min}$ (para 2-27)

22. $\frac{1500\text{ ml} \times 60\text{ gtts/ml}}{1440\text{ min}}$

$\frac{90{,}000}{1440} = 62.5 = 63\text{ gtts/min}$ (paras 2-7, 2-26)

23. $\frac{125 \text{ ml} \times 20 \text{ gtts/ml}}{60}$

$\frac{2500}{60} = 41.7 = 42 \text{ gtts/min}$ (paras 2-7, 2-16)

24. $\frac{25{,}000 \text{ units}}{500 \text{ ml}} = \frac{1500 \text{ units}}{X \text{ ml}}$

$25{,}000\,X = 750{,}000$

$X = 30 \text{ ml/hr}$

$\frac{30 \text{ ml} \times 60 \text{ gtts/ml}}{60 \text{ min}}$

$\frac{1800}{60} = 30 \text{ gtts/min}$ (paras 2-5, 2-6, 2-18)

25. a. 2.5 mg

b. $\frac{2.5 \text{ mg}}{1 \text{ tablet}} = \frac{5 \text{ mg}}{X \text{ tablets}}$

$2.5X = 5$

$X = 2$ tablets per dose

$\frac{2 \text{ tablets}}{1 \text{ dose}} = \frac{X \text{ tablets}}{3 \text{ doses}}$

$X = 6$ tablets per day

c. $\frac{200 \text{ mg}}{5 \text{ ml}} = \frac{X \text{ mg}}{1 \text{ ml}}$

$5X = 200$

$X = 40$ mg

d. $\frac{200\text{ mg}}{5\text{ ml}} = \frac{400\text{ mg}}{X\text{ ml}}$ or $\frac{40\text{ mg}}{1\text{ ml}} = \frac{400\text{ mg}}{X\text{ ml}}$

200 X = 2000 40 X = 400

X = 10 ml/dose X = 10 ml/dose

$\frac{10\text{ ml}}{1\text{ dose}} = \frac{X\text{ ml}}{4\text{ doses}}$

X = 40 ml/day

e. $\frac{40\text{ ml}}{1\text{ day}} = \frac{200\text{ ml}}{X\text{ days}}$

40X = 200

X = 5 days

f. $\frac{40\text{ mEq}}{30\text{ ml}} = \frac{30\text{ mEq}}{X\text{ ml}}$

40 X = 900

X = 22.5 ml

g. $\frac{15\text{ ml (1 T)}}{4\text{ oz}} = \frac{22.5\text{ ml}}{X\text{ oz}}$

15 X = 90

X = 6 oz (paras 2-5, 2-6, 2-10, 2-11, 2-14, 2-16, 2-17, 2-31--2-35)

26. a. yes

$\frac{1\text{ tsp}}{5\text{ cc}} = \frac{1/2\text{ tsp}}{X\text{ cc}}$

X = 2.5 cc

b. $\frac{0.8 \text{ ml}}{80 \text{ mg}} = \frac{2.5 \text{ ml}}{X \text{ mg}}$

$0.8 X = 200$

$X = 250$ mg

c. If needed; if temp is 101 or greater.

d. 1400 + 4 = 1800 hrs

e. 5 ml

f. $\frac{2.2 \text{ lbs}}{1 \text{ kg}} = \frac{22 \text{ lbs}}{X \text{ kg}}$

$2.2X = 22$

$X = 10$ kg

$\frac{8 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{10 \text{ kg}}$

X = 80 mg trimethoprim/day

$\frac{80 \text{ mg}}{2 \text{ doses}} = \frac{X \text{ mg}}{1 \text{ dose}}$

$2X = 80$

X = 40 mg trimethoprim/dose

$\frac{40 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{10 \text{ kg}}$

X = 400 mg sulfamethoxazole/day

$\frac{400 \text{ mg}}{2 \text{ doses}} = \frac{X \text{ mg}}{1 \text{ dose}}$

$2X = 400$

X = 200 mg sulfamethoxazole/dose (paras 2-5, 2-6, 2-10, 2-14, 2-17, 2-31--2-35)

27. $\frac{1 \text{ tab}}{10 \text{ gr}} = \frac{X \text{ tabs}}{600 \text{ mg}}$

$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{600 \text{ mg}}{X \text{ gr}}$

60 X = 600

X = 10 gr

10 gr = 1 tab (paras 2-5, 2-6, 2-10, 2-16)

28. 1 oz = 2 tbsp (para 2-10)

29. $\frac{1 \text{ tab}}{500 \text{ mg}} = \frac{X \text{ tabs}}{2.0 \text{ gm}}$

$\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{2.0 \text{ gm}}{X \text{ mg}}$

X = 2000 mg

$\frac{1 \text{ tab}}{500 \text{ mg}} = \frac{X \text{ tabs}}{2000 \text{ mg}}$

500 X = 2000

X = 4 tabs (paras 2-5, 2-6, 2-10, 2-16)

30. $\frac{1 \text{ oz}}{30 \text{ ml}} = \frac{X \text{ oz}}{45 \text{ ml}}$

30 X = 45

X = 1 1/2 oz (paras 2-5, 2-6, 2-10, 2-17)

31. $\frac{1 \text{ tab}}{\text{gr } 1/64} = \frac{X \text{ tabs}}{\text{gr } 1/32}$

1/64 X = 1/32

X = 2 tabs (paras 2-5, 2-6, 2-16)

32. $\frac{1 \text{ tab}}{125 \text{ mg}} = \frac{X \text{ tabs}}{0.5 \text{ gm}}$

$\frac{1 \text{ gm}}{1000 \text{ mg}} = \frac{0.5 \text{ gm}}{X \text{ mg}}$

X = 500 mg

$\frac{1 \text{ tab}}{125 \text{ mg}} = \frac{X \text{ tabs}}{500 \text{ mg}}$

125 X = 500

X = 4 tabs (paras 2-5, 2-6, 2-10, 2-16)

33. $\frac{1 \text{ tab}}{0.125 \text{ mg}} = \frac{X \text{ tabs}}{250 \text{ mcg}}$

$\frac{1 \text{ mg}}{1000 \text{ mcg}} = \frac{X \text{ mg}}{250 \text{ mcg}}$

1000 X = 250

X = 0.25 mg

$\frac{1 \text{ tab}}{0.125 \text{ mg}} = \frac{X \text{ tabs}}{0.25 \text{ mg}}$

0.125 X = 0.25

X = 2 tabs (paras 2-5, 2-6, 2-10, 2-16)

34. $\frac{1 \text{ cap}}{\text{gr } 1/8} = \frac{X \text{ caps}}{30 \text{ mg}}$

$\frac{60 \text{ mg}}{1 \text{ gr}} = \frac{X \text{ mg}}{1/8 \text{ gr}}$

X = 7.5 mg

$\frac{1 \text{ cap}}{7.5 \text{ mg}} = \frac{X \text{ caps}}{30 \text{ mg}}$

7.5 X = 30

X = 4 caps (para 2-16)

35. a. $\frac{125\text{ mg}}{5\text{ ml}} = \frac{0.25\text{ gm}}{X\text{ tsp}}$

b. $\frac{1\text{ gm}}{1000\text{ mg}} = \frac{0.25\text{ gm}}{X\text{ mg}}$

$X = 250$ mg

c. $\frac{125\text{ mg}}{1\text{ tsp (5 ml)}} = \frac{250\text{ mg}}{X\text{ tsp}}$

$125X = 250$

$X = 2$ tsp (paras 2-5, 2-6, 2-10, 2-11, 2-17)

36. $\frac{1\text{ tab}}{0.05\text{ mg}} = \frac{X\text{ tabs}}{25\text{ mcg}}$

$\frac{1\text{ mg}}{1000\text{ mcg}} = \frac{X\text{ mg}}{25\text{ mcg}}$

$1000X = 25$

$X = .025$ mg

$\frac{1\text{ tab}}{0.05\text{ mg}} = \frac{X\text{ tabs}}{.025\text{ mg}}$

$0.05X = .025$

$X = 0.5$ or 1/2 tab (paras 2-5, 2-6, 2-10, 2-16)

37. a. Sterile water or sodium chloride.

b. 1.4 ml.

c. $\frac{100\text{ ml} \times 60\text{ gtts/ml}}{90}$

$\frac{6000}{90} = 66.7 = 67$ gtts/min

d. $\frac{325\text{ mg}}{1\text{ tab}} = \frac{X\text{ mg}}{2\text{ tabs (1 dose)}}$

$X = 650$ mg/dose

e. $\frac{650\text{ mg}}{1\text{ dose}} = \frac{X\text{ mg}}{6\text{ doses}}$

X = 3900 mg (paras 2-5, 2-6, 2-11, 2-28, 2-31--2-35)

38. a. $\frac{300\text{ mg}}{2\text{ ml}} = \frac{120\text{ mg}}{X\text{ ml}}$

300 X = 240

X = 0.8 ml

b. $\frac{50\text{ ml} \times 60\text{ gtts/ml}}{30}$

$\frac{3000}{30} = 100\text{ gtts/min}$ (paras 2-5, 2-6, 2-27)

39. $\frac{\text{gr } 1/150}{1\text{ ml}} = \frac{0.3\text{ mg}}{X\text{ ml}}$

$\frac{1\text{ gr}}{60\text{ mg}} = \frac{1/150\text{ gr}}{X\text{ mg}}$

X = 0.4 mg

$\frac{0.4\text{ mg}}{1\text{ ml}} = \frac{0.3\text{ mg}}{X\text{ ml}}$

0.4 X = 0.3

X = 0.75 = 0.8 ml (paras 2-5, 2-6, 2-7, 2-10, 2-18)

40. $\frac{250\text{ units}}{500\text{ ml}} = \frac{7\text{ units}}{X\text{ ml}}$

250 X = 3500

X = 14 ml/hr

$\frac{14\text{ ml} \times 60\text{ gtts/ml}}{60}$

$\frac{840}{60} = 14\text{ gtts/min}$ (paras 2-5, 2-6, 2-28)

41. $\frac{100 \text{ ml} \times 20 \text{ gtts/ml}}{30}$

$\frac{2000}{30} = 66.7 = 67 \text{ gtts/min}$

(paras 2-7, 2-27)

42. a. $\frac{500 \text{ mg}}{2.7 \text{ ml}} = \frac{480 \text{ mg}}{X \text{ ml}}$

500 X = 1286

X = 2.6 ml

b. $\frac{25 \times 60 \text{ gtts/ml}}{30}$

$\frac{1500}{30} = 50 \text{ gtts/min}$ (paras 2-5, 2-6, 2-7, 2-27)

43. $\frac{100 \text{ units}}{1 \text{ ml}} = \frac{47 \text{ units}}{X \text{ ml}}$

100 X = 47

X = 0.47 ml (paras 2-5, 2-6, 2-18d)

44. $\frac{20{,}000 \text{ u}}{500 \text{ ml}} = \frac{700 \text{ u/hr}}{X \text{ ml/hr}}$

20,000 X = 350,000

X = 17.5 ml/hr

$\frac{17.5 \text{ ml} \times 60 \text{ gtts/ml}}{60}$

$\frac{1050}{60} = 17.5 = 18 \text{ gtts/min}$ (paras 2-5, 2-6, 2-18c)

45. $\frac{40{,}000 \text{ units}}{1 \text{ ml}} = \frac{11{,}000 \text{ units}}{X \text{ ml}}$

40,000 X = 11,000

X = 0.275 = 0.28 ml (paras 2-5, 2-6, 2-7, 2-18c)

46. $\frac{4 \text{ mg}}{1 \text{ ml}} = \frac{5 \text{ mg}}{X \text{ ml}}$

4 X = 5

X = 1.25 = 1.3 ml paras 2-5, 2-6, 2-7, 2-18)

47. $\frac{50 \text{ mg}}{1 \text{ ml}} = \frac{30 \text{ mg}}{X \text{ ml}}$

50 X = 30

X = 0.6 ml (paras 2-5, 2-6, 2-18)

48. $\frac{80 \text{ mg}}{15 \text{ ml}} = \frac{100 \text{ mg}}{X \text{ ml}}$

80 X = 1500

X = 18.75 = 18.8 ml (paras 2-5, 2-6, 2-7, 2-17)

49. $\frac{250 \text{ mg}}{5 \text{ ml}} = \frac{375 \text{ mg}}{X \text{ ml}}$

250 X = 1875

X = 7.5 ml (paras 2-5, 2-6, 2-17)

50. $\frac{125 \text{ ml} \times 15 \text{ gtts/ml}}{60}$

$\frac{1875}{60} = 31 \text{ gtts/min}$ (paras 2-7, 2-26)

**End of Lesson 2**